

**EFFECTIVENESS OF ICT TEACHERS' TRAINING PROGRAMMES IN
ENHANCING TEACHING AND LEARNING OF ENVIRONMENTAL
EDUCATION IN SELECTED PRIMARY SCHOOLS IN MUSOMA
DISTRICT**

FLORA MERCURY KIWONDE

**A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN EDUCATION OF
THE OPEN UNIVERSITY OF TANZANIA**

2018

CERTIFICATION

The undersigned certifies that they have read and hereby recommend for acceptance by the Open University of Tanzania a thesis titled; **Effectiveness of ICT Teachers' Training Programmes in Enhancing Teaching and Learning of Environmental Education in Selected Primary Schools in Musoma District**" in fulfilment of the requirements for the Degree of Doctor of Philosophy in Education of the Open University of Tanzania.

.....
Prof. Milline J. Mbonile
(Name of Supervisor)

.....
Date

.....
Dr. Kassimu A. Nihuka
(Supervisor)

.....
Date

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DECLARATION

I, Flora Mercury Kiwonde, do hereby declare that this thesis is my original work and has never and will not be presented to any other University or institution for the same or similar award.

.....
Signature

.....
Date

DEDICATION

This thesis is dedicated to my beloved mother, the late Stella Selunyungu Kiwonde and my mother in law the late Winfrida Lutoghoza Kamwesigile together with my late grandparents. Their love and guidance were missed while I was pursuing my study. I pray for their souls to rest in eternal peace. Amen.

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ABSTRACT

This study investigated the effectiveness of ICT teachers' training programmes in enhancing teaching and learning of Environmental Education (EE) in selected primary schools in Musoma district. The study adopted a case study research design employing both qualitative and quantitative approach. A total of 227 respondents drawn from 09 primary schools in Musoma district participated in the study, of whom 27 were teachers and 180 were pupils. The teachers were trained and oriented on ICT basic skills and how to integrate ICT in the teaching of EE in the study for a period of four weeks. Data were collected using classroom observations, interviews and questionnaires. Quantitative data were analysed using SPSS version 20 and the qualitative data were analysed using content data analysis. Findings indicated that ICT training programmes were being implemented and that they were useful to teachers. However, even after training most teachers used their own initiatives to integrate ICT during teaching and learning of EE. Integrating ICT in teaching and learning of EE faced challenges related to few training opportunities for teachers and the pupils, shortages of ICT facilities in schools, and training was done with less practical components. The study suggests for the sufficient ICT training programmes that will merge both the theoretical and practical parts of the training. In addition, the ICT trainings need to have definite content to be covered. It is also important for increasing supply of ICT facilities in schools for enhancing the integration of ICT in the EE teaching and learning processes to facilitate the ongoing struggle to preserve the environment for sustainable development. In this study teaching and learning of EE using ICT facilities is considered crucial to address the environmental problems especially during this era of advancement in ICT.

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LIST OF ABBREVIATIONS AND ACRONYMS

BECTA	British Educational Communications and Technology Agency
EE	Environmental Education
ESR	Education for Self Reliance
ICT	Information and Communication Technology
IT	Information Technology
MoEVT	Ministry of Education and Vocational Training
NGOs	Non-Governmental Organizations
OUT	Open University of Tanzania
TEHAMA	Teknolojia ya Habari na Mawasiliano
TEA	Tanzania Education Authority
TIE	Tanzania Institute of Education
TPACK	Technological Pedagogical Content Knowledge
URT	United Republic of Tanzania
UNESCO	United Nations Education, Scientific and Cultural Organization
USAID	United States Agency for International Development
WWF	World Wide Fund for Nature

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter introduces the study that investigated the effectiveness of Information and Communication Technology (ICT) training programmes in enhancing teaching and learning of Environmental Education (EE) in primary schools in Musoma district, establishes its importance and explains its significance. The chapter sets the topic in perspective by stating the need and background of the study, statement of the problem, objective of the study, limitations and delimitations of the study and the definitions of the key terms used in this study.

1.2 Background of the Study

Various efforts have been committed in the education system in order to improve the teaching and learning process using ICT. The efforts include pre-service and in-service ICT teachers' training programmes (Afshari, 2009) that have been introduced in the education system. The ICT training programmes are envisaged to strengthen EE teaching and learning process enhanced by ICT facilities (ASEE, 2009). However, studies show that the use of ICT in teaching EE is still shaky in primary schools (Abdelwahed, 2016; Houcine, 2011; Lin, 2011; Shadreck, 2009). This is also the case in Tanzania where studies indicate emphasis in teaching EE (Kimario, 2011; Mtaita, 2007; Ballantyne, Fien & Packer, 2001).

According to Wilke, Peyton and Hungerford (1980), EE competency is the ability to provide learners with the ecological knowledge, conceptual awareness, investigative analysis skills, and participatory action skills needed to become environmentally

literate citizens. Therefore, EE is a life-long process that leads to an informed and involved citizen having the creative problem-solving skill, scientific, economic and social literacy in order to attain sustainable development. While there are many places where EE is implemented, the most common locations are schools and other educational centres/institutions (Henegar, 2005; Baraza & Alfredo, 2004).

Mulhim (2013) shows that the use of technology in primary schools is very low despite various ICT training programmes conducted to teachers. Studies in Sudan (Abdelwahed, 2016), in Algeria (Houcine, 2011), in Taiwan (Lin, 2011), in Zimbabwe (Shadreck, 2009), in Slovenia (Brečko, 2008) on the other hand show that the use of ICT in environmental studies lessons in education sectors particularly in primary schools is not encouraging due to among other challenges lack of technology amongst teachers. Studies in Tehran (Afshari, 2009), Hong Kong and Singapore (Wong and Li, 2008) revealed that transformational leadership, leadership promotion of collaboration, experimentation and teachers' dedication to learner-centred learning influence effective ICT transformation.

The study in Uganda recommends that, the training of teaching staff in the teachers' pedagogical issues should be increased if teachers and administrators are to be convinced of the value of using ICT in their teaching-learning process (Guma, 2013). Technology is currently given priority because it is considered as the solution for searching information since pupils and instructors can get environmental topics and information through e-learning (Lin, 2011).

In Tanzania, currently both ICT and EE are topical agenda in the education system (MOEVT, 2007). ICT teachers' training (both initial and in-service) is a top priority

with regard to the inclusion and the use of ICT in the education system (European Commission, 2001). Most countries aim to offer ICT training that varies widely in content, duration and mode of delivery, at several levels, in an effort to address both basic computer skills as well as the pedagogical incorporation of ICT into the educational process. Studies show that effective ICT training should be enhanced with teachers' pedagogical support, technical support and other form of support from the management so that teachers are able to design and develop their courses, deliver content and design the students' activities (Fisser, 2001; Bates, 2000).

The Ministry of Education and Vocational Training (MoEVT) introduced the ICT pedagogy in Tanzanian Teachers' Colleges (TTCs) in 2005 as one of the necessity to equip teachers with relevant skills and competences on ICTs integration in teaching and learning (MoEVT, 2005). ICT subject in TTCs is regarded as a way of improving teaching and learning in schools because teachers would access knowledge and skills to use ICT facilities to enhance their teaching. Both pre-service and in-service training programmes assist teachers to move faster and adopt technology while they show the more enthusiastic teachers' new ways in implementing ICT into their profession.

The courses aim to improve teachers' ICT proficiency at three levels: ICT skills, pedagogical skills, and curriculum training (Alutaibi, 2009). In addition, the Tanzania government introduced ICT curriculum in primary schools since 2005 as one of the subjects to be taught in primary schools. On the other hand, in ensuring that ICT is adequately implemented in primary schools, the government formulated the ICT policy for basic education in 2007 (URT, 2007).

However, limited studies have been conducted since the introduction of ICT curriculum in TTCs as well as after the commencement of various in-service training programmes in schools as to how they have enhanced the teaching and learning of EE. Awareness of environmental issues enhanced with ICT knowledge in this era of globalization and digital world is of necessity particularly in primary education which is considered to be the basic education in the country with every citizen having the right to get it (MoEVT, 2005). The initiative by the Tanzanian government to integrate EE into various subjects in primary school curriculum is commendable. This is due to the fact that Tanzania's economy is largely dependent on the country's environment and natural resources (URT, 2006).

Natural and human-made environmental issues and problems, like drought, floods, climate change and loss of biodiversity are urgent threats and challenges of our time (Viterito, 2016). These problems are a result of various factors like population pressure, poor agricultural practices and high rate of urbanization (Johnson-Pynn, 2005). Therefore environment should be conserved for provision of resources that will lead to a comfortable life (Mondal, 2017). Education for awareness-raising and finding solutions for these issues using modern methods of provision of education is considered necessary.

To effect EE, Environmental Management Act no. 20 (URT, 2004), provides out explicitly that EE is a statutory requirement for bringing about sound environmental and natural resources utilization in Tanzania. In improving the quality of life and social well-being of its people, Tanzania has as one of the goals of the country's national strategy for growth and reduction of poverty to "Increase access to clean

water, affordable and safe water, sanitation, decent shelter and a safe and sustainable environment.” (URT, 2006, p. 20). It is envisaged that EE will assist people particularly pupils in primary schools to be aware of the components of EE including knowledge and understanding, attitudes, skills, participation, awareness and sensitivity (EPA, 2017).

Although EE has been included in the school curriculum in Tanzania from the 1960s, (Osaki, 1995) and also emphasized in the Education and Training Policy of 1995, the condition of the environment has not improved and the country is still struggling towards environmental management and conservation. Mtaita (2007) suggests that EE should be effectively taught in schools using modern methodologies for awareness of environmental issues. Evidence of environmental degradation in the forms of soil erosion, poor waste management, water pollution and many other problems can still be observed in many schools and also in the communities around the schools.

The school is part of the community, therefore it is expected that what the pupils learn in schools are also reflected in society. Other scholars point out that the teaching and learning methods used in schools, emphasize knowledge and awareness-raising only (Bolstad, 2004). As such, people can be aware but unable to take action. Spiropoulou (2007) argues that the implementation of EE has been less effective among other reasons due to the traditional teaching approaches. It is envisaged that, the proper use of modern technology can assist pupils to actively participate in the learning while acquiring knowledge and developing necessary skills for environmental management.

The formulation of the ICT Policy was preceded by the programme of introducing ICT curriculum in all government teachers' colleges in August 2005, which was conducted by the government of the United Republic of Tanzania in collaboration with the Swedish Government through the Swedish International Development Cooperation Agency (SIDA). The programme's main goal was to improve the quality of pre-service and in-service teachers' education by using ICT (MoEVT, 2007). In that programme; principals, tutors and student' teachers were trained in ICT to be able to use ICT as a tool for teaching and learning among other uses. The benefits of preparing teachers using ICT was expected to spill over to schools when implementing initiatives like e-school or e-learning.

The official commencement of ICT teaching at primary school level in 2011, on the other hand, aims at enhancing teachers' knowledge and skills in facilitating pupils to learn the basic knowledge about the use of available ICTs. The major objective of ICT subject in primary schools as stipulated by Tanzania Institute of Education (TIE) is to provide knowledge to the pupils that will assist them in using the acquired information to access knowledge in different disciplines including EE. It is predicted that from the ICT, pupils will be able to access information from computer, internet, telephone, television, radio, newspapers, to mention some of them (ibid). Scholars show that the mentioned efforts had the aim of assuring immediate actions particularly through education trainings in order to reduce the impacts of environmental degradation to the future (Viterito, 2016; Chi-chung-Ko, 2003).

1.3 Statement of the Problem

Effective education system depends heavily on effective teaching and learning

process. Effectiveness of teaching and learning however, depends on effective methodologies and availability of facilities particularly modern facilities to keep pace with the development of technology. One of the objectives of implementing ICT teachers' training programmes in Tanzania was to bring the notable improved teachers' teaching practices as well as improvement of lives of people in Tanzania (MOEVT, 2007). Hence, if effectively planned and implemented, ICT training for teachers in schools is considered vital for the sustainable development of education system (Sodhi, 2013) and therefore for the awareness of environmental issues amongst teachers and pupils.

However, despite various efforts committed by the government in Tanzania, not to mention the rapid growth in ICT awareness by teachers and pupils, most EE teachers are reluctant in adapting and integrating ICT tools during teaching and learning process (Shadreck, 2009). It appears that teachers have not been equipped with knowledge and skills on how to use the modern ICT facilities in teaching and learning process. It is against this background that the investigation of the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in primary schools was conceptualized.

The ICT teachers' training programmes enable teachers to acquire relevant teaching knowledge and skills through which EE is properly taught to pupils of different backgrounds in primary schools using ICT facilities. Noe (2010) is of the view that effective training programme depends on the following characteristics: training needs assessment, objectives and outcomes of the training, relevant content directly linked to trainee job experiences, opportunities for practice, regular feedback during

training and post-training environment where teachers are given opportunities to perform the skills they learnt. ICT training programmes in education sector are yet to take its roots (Sooraj, 2013), this is the case in Tanzania where education delivery using ICT is still new and facing challenges (Ngeze, 2017; Malero, Ismail & Manyilizu, 2015; Sedoyeka & Gafufen, 2013; Mwalongo, 2011).

Various studies have been conducted with regard to ICT especially about the challenges teachers are facing in teaching EE using ICT facilities (Abdelwahed, 2016; Houcine, 2011; Lin, 2011). However, the review of various literature show that limited number of studies exist in ICT particularly on the ways ICT teachers' training programmes are effective in enhancing teaching and learning of EE. In this era of advanced technology the ICT policy foresees the use of a wide range of ICTs, from radio and mobile telephony to computers and internet (MOEVT, 2007), to reach educational objectives. Mara region is richly endowed with various types of resources particularly minerals. Hence, like other lake zone regions, a number of environmental problems including water and air pollution from mining sites are conspicuous (WWF, 2014). This study therefore investigated the effectiveness of ICT teachers' training programmes in enhancing the teaching of EE in 09 primary schools in Musoma district. It is envisaged that new ways of education provision using modern teaching methods among other strategies can assist to minimize the environmental challenges.

1.4 Objectives of the Study

The main objective of this study was to investigate the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in selected

primary schools in Musoma district. The specific objectives of the study were as follows:

- i. To identify challenges and opportunities encountered by teachers and pupils in the current ways of teaching and learning EE.
- ii. To analyse the characteristics of ICT teachers' training programmes that were organized to orient teachers on ICT integration to enhance teaching of EE.
- iii. To examine the extent to which the ICT teachers' training programmes were effective in enhancing teachers' professional competence in teaching and pupils' learning of EE.
- iv. To examine the strategies for effective mainstreaming of ICT in teaching and learning of EE in primary schools.

1.5 Research Questions

The main research question for the study was: In which ways were the ICT training programmes effective in enhancing teaching and learning of EE in primary schools in Musoma district? The main research question was addressed by answering the following sub-research questions:

- i. What were the challenges and opportunities encountered by teachers and pupils in the current ways of teaching and learning EE?
- ii. What were the characteristics of ICT teachers' training programmes and how did they contribute to effective training of teachers' on the use of ICT to enhance teaching of EE?
- iii. How were the ICT teachers' training programmes effective in enhancing teachers' integration of ICT in teaching and pupils learning of EE?

- iv. What strategies are effective for mainstreaming ICT to enhance EE teaching and learning in primary schools?

1.6 Significance of the Study

The study is significant in the following ways; firstly, it has contributed to the existing body of knowledge as limited studies have been conducted in the ICT area specifically with regard to ICT integration in teaching and learning of EE. The ICT Policy for Basic Education stipulates a vision of having a well-educated and learning knowledge society. The policy has a mission of integrating ICT in order to enhance access, equity, quality and relevance of basic education, while stimulating and improving teaching and lifelong learning (MoEVT, 2007). It is envisaged therefore that, this study will contribute in ICT enhanced and well-educated primary school teachers.

Secondly, knowledge generated from the study will inform best practices. Basing on the findings, the study suggests how best primary schools can be used as agents for environmental management and protection through the use of ICT. This will further enhance the contribution to the environmental sustainability as per goal number seven (target 9) of Sustainable Development Goals (SDGs). Goal number seven suggests for the integration of the principles of sustainable development into the country policies and programmes to reverse the loss of environmental resources. In addition, goal number eighteen (target 18) suggests for the available enhanced benefits of new technologies especially ICT through the use of internet, computers, telephone lines and cellular subscribers (URT, 2007).

Thirdly, findings of the study suggest how best the policy makers in the education system can plan effective ICT training programmes. The programmes are envisaged to assist teachers get the ICT knowledge that will assist them to integrate the ICT to improve the teaching and learning of EE. The study expected to generate useful information for researchers, environmental managers, educators and ICT training planners in enhancing policy reviews in the context of using ICT in teaching EE.

1.7 Limitations of the Study

Most of the schools in the selected area were not enriched with ICT services hence it was not easy to select the sample suitable for the study. Because the study was conducted in urban area, carefully investigation was done to sample schools that were seen to have ICT facilities however limited they were.

1.8 Delimitations of the Study

The study was conducted specifically at Musoma district in Mara region. Also the study confined itself in the population of primary schools' teachers and pupils. The samples for representing the population were selected in 09 primary schools. The study also reviewed literatures that are related to ICT and EE.

1.9 Definition of Key Terms

In this study various concepts have been used to enrich the study. However the key concepts are hereunder conceptualized.

ICT has been defined by MOEVT (2007) to include all forms of technology that are used for communication and to transmit, store, create, share or exchange

information. This broad definition of ICT includes technologies such as: radio, television, video, telephone (both fixed line and mobile), computer and network hardware and software; as well as the equipment and services associated with these technologies, such as electronic mail, text messaging and radio broadcasts. On the other hand ICT is considered as forms of technology such as computers, mobile phones and internet that are used to support the livelihoods and mitigate some of the challenges in addressing unemployment and poverty (Makoza et al., 2014). In this study ICT is considered to encompass all forms of technology that can facilitate the teaching and learning of EE in primary schools.

Environment can be defined as the natural surroundings of the organism which directly or indirectly influence the growth and development of the organism (Ponnuswami, 2018). Environment is also the sum total of conditions that surround us at a given point of time and space. It is comprised of the interacting systems of physical, biological and cultural elements which are interlinked both individually and collectively. Environment consists of atmosphere, hydrosphere, lithosphere, and biosphere. Its chief components are soil, water, air, organisms and solar energy. Environment has provided us with all the resources for leading a comfortable life (Mondal, 2017). In this study the term environment means the surroundings that, if well conserved through provision of proper education to people, can assist people get the needed resources to lead a better life.

Environmental Education is a learning process that increases people's knowledge and awareness about the environment and associated challenges; it develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible

action (UNESCO, Tbilisi Declaration, 1978). The environment is of vital importance to human beings as it provides settlements, land for cultivation, the atmosphere for fresh air, whereas the ozone layer protects the earth from harmful radiation of the sun.

Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions (EPA, 2017). In this study EE is considered as the system of providing to pupils and other environmental stakeholders with various principles that can raise pupils and peoples' awareness of the environment.

In-Service Training is the training designed to develop skills of people who are already working in a particular profession. The training is usually given to employees during the course of employment (Bullullough, 2009). In-service training on the other hand is the education that a teacher receives after entering a teaching profession after having the education in the teachers' colleges. It includes all the programmes such as educational, social and others in which the teacher takes a virtual part, at different institutions by way of refresher and other professional courses and travels and visits he/she undertakes (Sooraj, 2013). In this study in-service training was considered to be the ICT training programmes that were planned to be provided to teachers after they received the training in the teachers' colleges.

Pre-Service Training is the training to individuals for preparing them to meet the requirements for a professional field. The training is relating to the period before a

person takes a job that requires training (Education System Report, 2013). Pre-service education of teacher means, education of teachers before they enter into service as teachers. During this period of teacher education programmes, teaching practice goes side by side; while teachers are getting knowledge about theory papers. The programmes are intended to support and enhance teachers' learning instilling into them a greater degree of self-confidence. The beginning teachers in this case learn from their practice, culture and norms of the unique school settings where they have been placed (Sooraj, 2013). In this study the pre-service training are referred to as the ICT courses that the primary school teachers have undergone during their preparation towards teaching profession.

Training Programmes are well organized opportunities that help employees or participants to acquire necessary knowledge or skills in order to improve performance in their current roles. Training programmes can be formal or informal programmes of in-service education organized from time to time. The training programmes are organized by the higher authorities concerned with education system in order to ensure that the standards of education are properly maintained (Sooraj, 2013). In this study the training programmes were considered to be the ICT training programmes that are organized by MOEVT in order to equip primary school teachers with the ICT knowledge and skills.

1.10 Organisation of the Thesis

This thesis is organized into six chapters. Chapter one presents the introduction of the thesis including the problem and its setting. Chapter two provides the literature review while chapter three provides research methodology. Chapter four

encompasses the presentation of the findings. Chapter five provides the discussion of the findings. Chapter six is devoted to the conclusion, recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature related to the study that investigated the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in primary schools in Musoma district. Literature review provides an in-depth familiarization of the theoretical perspectives for the study, the problem under the study and how other studies have addressed the problem, the emerging gaps in the body of existing studies that are yet to be bridged in order to solve the problem and the conceptual framework of the study.

2.2 Theoretical Perspectives for the Study

In this study various theories that are related to teaching and learning as well as ICT theories were reviewed in order to get the theory for the study. The theories reviewed include cognitivistic view of learning, constructivism learning theory and the convergence theory on ICT.

2.2.1. Cognitivistic View of Learning Theory

Cognitive theories take the perspective that learners actively process information and learning takes place through the efforts of the learners as they organise, store and find relationships between information, linking new to old knowledge (FISTE, 2011). Ausubel, Bruner and Gagne are three exponents of the cognitivism who add different perspectives to learning as information processing. The theory considers learners to have more responsibilities of their own learning as they seek out, find, synthesize, and share their knowledge with others (Majumdar, 2006). However the

major disadvantage of cognitive learning theory is that it is a teacher based learning. While schemas help to make learning more meaningful, a learner is at disadvantage whenever relevant schemas or prerequisite knowledge do not exist. To account for this, a designer will need to ensure that the instruction is appropriate for learners (Dayang, 2013).

2.2.2 Constructivist View of Learning Theory

The theory of constructivism suggests that learners construct knowledge out of their experiences (Doğru and Kalender, 2007). According to the theory, learning happens when learners are using their experiences to construct and deconstruct their own understanding and knowledge. The formalization of constructivism from the human perspective is generally attributed to Jean Piaget (Doğru and Kalender, 2007), who articulated mechanisms by which information from the environment and ideas from the individual interact and result in internalized structures developed by learners.

Learners normally bring unique prior knowledge, experience, and beliefs to a learning situation. Every learner has experiences that influence his/her learning which assist in the learning. The following are applications of constructivist theory in teaching and learning: Learners are actively using what is learned and anchoring learning in a meaningful context, revisiting content at different times, for different purposes, and from different conceptual perspectives, developing pattern-recognition skills, presenting alternative ways of representing problems, presenting new problems and situations that differ from the conditions of the initial instruction (Peggy, 2013).

2.2.3 The Convergence Theory on ICT

The convergence theory could be seen as a synthesis or aggregation of the initial theoretical models. The convergence model is primarily a graphical illustration of ongoing changes in the society (Bradley, 2010). In this model, the converging technologies are considered to be: computer technology, tele-technology and media technology. The convergence process is enforced all the time by smaller, cheaper, and more powerful technical components. ICT is increasingly being used in almost every activity and embedded in more and more things (ubiquitous computing). Both convergence and interactions are important features in the model. Convergence here means a move towards a common content. Interaction means that- technology interacts with the social world with values and beliefs (ibid).

Various scholars have applied the convergence model in their studies that are related to ICT. Danielsson (2007) for example applied the convergence model in her thesis “Relationships between Information Communication Technology and Psychosocial Life Environment: Students and Young Urban Knowledge Workers in the ICT”. Johnson (2005) applied the convergence theory in the new organizational structures, presented in her thesis on “Working Together when being Apart.

An Analysis of distributed Collaborative Work through ICT from Psychosocial and Organisational Perspective”. Definition and then operationalisation of theoretical concepts are permanent tasks for research in the field, since the basic structures are changing and new ones are appearing and identified. However, for the purpose of this study, constructivist theory has been used because ICT facilities assist learners to apply the prior knowledge and learn on their own.

2.3 Learner – Centred Teaching and Learning of EE

According to the constructivist theory, through using ICT, the teacher plays the role of task designer and knowledge facilitator. The teacher creates the learning environment in such a way as to enable the acquisition of new knowledge. From a constructivist perspective, the primary responsibility of the teacher is to create and maintain a collaborative, problem-solving environment, where learners are allowed to construct their own knowledge, and the teacher acts as a facilitator and guide (Tambyah, 2008). Having the teacher's feedback on the task, the learners will then reconsider prior understandings and knowledge and form new conceptions of the EE subject matter.

In constructivism theory the role of the teachers will change from knowledge transmitter to that of facilitator, knowledge navigator and sometime as co-learner (Majumdar, 2006). The new role of teachers demands a new way of thinking and understanding of the new vision of learning process. Learners will have more responsibilities of their own learning as they seek out, find, synthesize, and share their knowledge with others. ICT provides powerful tools to support the shift from teacher-centred to learner-centred paradigm and new roles of teacher, learner, curricula and new media (ibid). The major shifts have been described in a Table 2.1.

Table 2.1: Changes in Teachers' Roles

From	To
Transmitter of Knowledge	Guide and Facilitator of Knowledge
Controller of Learning	Creator of Learning Environment
Always Expert	Collaborator and Co-learner
Learning to use ICT	Using ICT to Enhance Learning
Deductive/Expository	Interactive/Experimental/Exploratory

Source: Majumdar, (2006, pp.4)

Learning of ICT skills does not suffice, but using ICT to improve the teaching and learning is the key for pedagogy-technology integration. While delivering the class lectures, any innovative teacher needs to draw diagrams, show pictures, animate some objects to explain critical concepts, even play some video clipping of real time operation. All these multimedia applications can assure very productive, interesting, motivating, interactive and quality delivery of classroom instruction. Presentation of software like power point can be a good choice for teachers to perform such tasks. In a multimodal classroom environment, it is possible to satisfy all categories of learners such as fast learners, average learners and slow learners with their specific learning styles through interactive multimedia based instructional materials. Technical equipment such as computers, for instance, can assist EE teachers in their daily work of teaching and learning (ibid).

Majumdar, (2006) found that education around the world is experiencing major paradigm shifts in educational practices of teaching and learning under the umbrella of ICT enabled learning environment. Therefore the current focus is now on the role of the learner through the use of technology. Technology has been changing drastically from traditional instruction to virtual learning environment as depicted in Table 2.2.

Table 2.2: Changes in Teaching-Learning Environment

Model	Focus	Role of Learner	Technology
Traditional	Teacher	Passive	Chalk and talk
Information	Learners	Active	Personal computer
Knowledge	Group	Adaptive	PC and network

Source: Majumdar, (2006)

2.4 The Potential of ICT Training Programmes to Teachers

Numerous research studies indicate that ICT can change the way teachers teach and that it is especially useful in supporting more learner-centered approaches to instruction and in promoting collaborative activities (Haddad, 2003; Majumdar, 2006). Recognizing the importance of ICT in teaching and learning, majority of the countries in the world have provided ICT training to teachers in a variety of forms and degrees. There seem to be several efforts around the world in which countries are effectively using technology to train teachers, and/or train teachers to use technology as tools for enhancing teaching (Majumdar, 2006) and particularly teaching and learning of EE.

Modern developments of innovative technologies have provided new possibilities to teaching professions, but at the same time have placed more demands on teachers to learn how to use these new technologies in their teaching (Robinson and Latchem, 2003). These challenges require teachers to continuously retrain themselves and acquire new knowledge and skills while maintaining their jobs (Carlson and Gadio, 2002).

Using ICT, teachers of EE can identify a problem or issue which is relevant to the learners. It may be an international, national, local, or a personal problem. Examples might be water shortage, earthquakes, poverty, and climate change, to mention but a few. The problem should incorporate key concepts from the curriculum and be presented to learners in a vivid and stimulating way, for example by a video case study, internet, blogs, wikis, video, audio, e-learning management system, web pages, online storage, to mention a few. The interaction created by ICT in teaching

can promote a deeper understanding of the subject matter and a respect for the views and attitudes of others. The learning activity based on the problem should be suited to the knowledge, skills, and experiences of the learners, but also challenge them (UNESCO, 2011).

Although educational technology is not the panacea for educational challenges, it does leverage and extend traditional teaching and learning activities in certain circumstances and hence has the potentiality to impact on learning outcomes.

Knapper (2001) states that:

..... technology may be a good solution for some instructional problems, and in some cases it may be a partial solution. But in other instances technology does little to address the fundamental teaching and learning issue or – even worse – provides a glitzy but inappropriate solution to a problem that has simply been misconstrued (Knapper, 2001: 94).

The trick is to identify situations where educational technology will be appropriate and when and how to use educational technology in these situations. However various studies show that the use of ICT in schools is still limited due to, among other factors, lack of effective training. In Saud Arabia for instance Mulhim (2013) made a study to investigate the overall focus of ICT in primary schools, a study that aimed to discover whether a tailored training programme might help teachers to widen and improve their use of ICT, and thus to improve their pupils' results.

The study found out that the current use of technology in Saud Arabia is very low. The reasons behind this could include lack of access to technology, lack of training, and lack of time. One of the drawbacks of teachers' training programmes in ICT especially in developing countries is that these programmes cannot link theory and teaching practice effectively (Politis, 2000). Teachers consider the use of ICT in

these training programmes as more mechanistic and meet the needs neither of the modern school nor of the teacher, who should form a citizen with critical thought through educational procedures and processes. The study was finalised by a conclusion that, only a small percentage of teachers do not believe in the suitability and the success of training they got (Mulhim, 2013).

2.5 The Potential of ICT in Enhancing Teaching and Learning of EE

The role of information and communication technologies (ICTs) in educational and business institutions of the 21st century cannot be overemphasized (Shadreck, 2015; Dawes, 2001). The potential of ICTs is in supporting the school curriculum and education through the provision of effective communication opportunities for students and teachers (Dawes, 2001; Chan, 2009). The importance of ICTs in education calls upon educationists to identify the challenges to the integration of ICTs into teaching and learning in order to improve the quality of teaching and learning. Becta (2005) notes that literature abounds with information on barriers to ICT integration in general, but very few studies look at obstacles that exist in specific subject areas, thus investigating the challenges that educationists encounter in specific situations is very essential as it assists educationists to overcome these obstacles and integrate the ICTs into their teaching and learning.

ICT have great potential in facilitating course delivery and in supporting pupils. It is anticipated that where appropriate ICTs are used, then there is a possibility of improving teaching and learning processes (Chan, 2009; Nihuka, 2011). The integration of ICT into the idea of teaching and learning always places pedagogy over technology. It is not the only concern to master ICT skills, but rather it involves

using ICT to improve teaching and learning. It permits the move from reproductive model of teaching and learning to an independent, autonomous learning model that promotes initiation, creativity and critical thinking with independent research. Pupils are expected to collect, select, analyze, organize, extend, transform and present knowledge using ICT in authentic and active learning paradigm. In that case, EE teachers are expected to create a new flexible and open learning environment with interactive, experiential and multimedia-based delivery system.

ICT contributes to creating powerful learning environments of EE in numerous ways. ICT provides opportunities to access an abundance of EE information using multiple information resources and viewing information from multiple perspectives, thus fostering the authenticity of learning environments. ICT may also make complex processes easier to understand through simulations that, again, contribute to authentic learning environments. Furthermore, ICT may serve as a tool to curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of each individual pupil and by providing tailored feedback (Smeets and Mooij, 2001).

Niederhauser and Stoddart (2001) distinguish two main types of software use in education: skill-based transmission software, and open-ended constructivist software. Skill-based software aims at enhancing learners' skills by administering drill and practice exercises whereas open-ended software may serve as a tool for helping learners build knowledge. This type of ICT use may be expected to contribute especially to powerful learning environments. However, research shows that the focus in schools in general is on traditional, skill-based ICT use (Smeets,

2001; Williams, 2000). The study made in Algeria found that ICT impacts positively on the learning process (Houcine, 2011). Teachers report that the information that is obtained via internet is more up to date and broad-ranging than conventional library resources (Hennessy *et al*, 2003). ICT use serves to broaden reference, reduces laboriousness and increases efficiency, improves pupils' motivation and the quality of work, and facilitates learning.

Another aspect which may influence the use of ICT is access to technology. This refers not only to the number of computers, but also to the placement of the equipment, for example in the classroom or in a computer room. Kennewell (2000) feels it is essential that computers be placed in the classroom, in order to maximize the opportunities for curriculum activity. ICT is considered to be the most cost-effective means for bringing the world into the classroom; and offers (via the internet) teachers and learners' platform through which they can communicate with colleagues from distant places, exchange work, develop research, and function as if there were no geographical boundaries (Haddad, 2009).

Radio and television have been used widely as educational tools since 1920s and 1950s, respectively. There are various approaches to the use of radio and TV broadcasting in education (UNESCO, 2007), one being direct class teaching, where broadcast programming substitutes for teachers on a temporary basis; second is a school broadcasting, where broadcast programming provides complementary teaching and learning resources not otherwise available; and third general educational programming over community, national and international stations which provide general and informal educational opportunities.

2.6 Teachers and Pupils' ICT Literacy

UNESCO's framework emphasizes that it is not enough for teachers to have ICT competencies and be able to teach them to their pupils. ICT training should enable teachers to be able to help pupils become collaborative, creative learners with problem solving so that they are effective citizens and members of the workforce (UNESCO, 2011). Although primary school teachers appeared to be aware of the potential of ICT, they suggested that there is a need for more and better training and time to practice what has been learnt in formal training sessions. Also, teachers felt a need to improve the use of ICT in administration and management of teaching and learning for example the access to and analysis of pupils' progress data.

In addition teachers suggested that the ICT training should have adequate time and quality ICT resources (Selwood, 2007). ICT also opens up opportunities for EE learning because it enables learners to access, extend, transform and share EE information and ideas in multi-modal communication styles and format. Appropriate use of technology in teaching extends, enriches, conducts, individualizes, differs and broadens the entire curriculum (Phalen, 2004). ICT can help achieve this in different ways: by encouraging every learner to be active and have a more deepened approach in learning, by encouraging to choose and adapt in new learning ways, by opening new horizons about learning opportunities and consequently interest, with which a learner gains habits for a lifelong learning (RutarIlc, 2008).

Laurillard (2006) developed educational technology-based resources guidelines that provide a framework which relates ICT-based resources to particular teaching and learning activities. The guidelines therefore suggest particular uses of ICT for

particular teaching and learning situations. Primary schools' institutions should be regarded as important part of educational strategy for equipping pupils with proper environmental knowledge, attitudes and skills for this is the only formal education that most Tanzanians are likely to receive.

The primary education should help young people to acquire skills and attitudes which would help them improve their lives and that of others after completing the primary school education. Wangari (2009) suggested that EE should start in early ages especially when the pupils begin their primary school education so that they grow up with the habit of protecting their surrounding environment. Therefore, EE teachers should use ICT facilities to support learning and teaching and the noticeable changes that their ICT work will bring in the society.

2.7 Teachers' ICT Pedagogical Knowledge

Not only mastering ICT skills, but also utilizing ICT to improve teaching and learning is of utmost importance for teachers in performing their role of creators of pedagogical environments. While literature provides some evidence of the effectiveness of using ICT in technical considerations, little is known about which learning strategies and pedagogical framework should be used for education and training, and guiding principles of teacher development for pedagogy-technology integration (Majumdar, 2006). As we are increasingly supported by ICT, teaching and learning are not the same as before. We will have to make use of the rich and exciting opportunities offered by the new technologies in education to reach our new goal and vision.

Teachers need to possess a special form of expertise for teaching that is derived from the combination of both their content knowledge and pedagogical knowledge. This unique form of teachers' expertise known as pedagogical content knowledge (PCK) is describing the teachers' expertise for teaching particular subject matter. Technological pedagogical content knowledge was initially given the acronym of TPACK to emphasize the integrated use of Technology, Pedagogy and Content Knowledge for effective technology integration (Thompson and Mishra, 2007).

2.8 Teachers' ICT Support

According to Teo (2007) the success of any initiative to integrate technology in an educational system depends strongly upon the support and attitude of the education system of the particular context. In Tanzania, for instance, one of the objectives of ICT Diploma Teachers' Syllabus is to help learners to realize the role of ICT in socio-economic and cultural development of the society (MOEVT, 2007). Thus, the teacher education curriculum needs to introduce ICT to cater for social and cultural demands of Tanzanian citizen including environmental issues within the country.

Based on this shift, ICT is expected to facilitate the access to various sources of knowledge for enhancing learner-centred approaches in teaching and learning. In addition to this, Tanzania education has to prepare learners to join the knowledge based on economy, where individuals become self-advanced and liberated educationists for lifelong learning. On the other hand, Williams (2001) conducted a research on ICT Support for Teachers in Scotland and highlighted a number of issues which should be considered when planning ICT support for schools. The support needed to teachers include pedagogical support, technical support, management

support and infrastructure support to mention a few.

2.8.1 Pedagogical Support

A number of issues may hinder schools and teachers in their efforts to fully benefit from ICT windows of opportunity. However, a fundamental issue is whether teachers know how to use ICT effectively in their teaching. Nonetheless, it is important to set out the basic principles which should guide the use of ICT in teaching, and this is why the UNESCO ICT Competency Framework for Teachers (ICT-CFT) project draws attention to the many ways in which ICT can transform education (UNESCO,2011). In addition the institution should foster a supportive institutional environment that rewards innovation in teaching and learning practice and provide the necessary technological teaching and learning tools.

The implementation of EE through the use of ICT seems to be a complex process, hence raising some controversial issues to educators. Responding to these controversies of EE in the Primary School Curriculum (PSC) some scholars state that, in the course of implementation of the new curriculum, a number of educational aspects needed to be rethought (ASEE, 2009). These are but not limited to the contextualized curriculum with the pedagogical approach resonating with pupils and teachers' learning styles. Also the plethora of cultural, technical, environmental, and other contextual issues need to be taken into account in the curriculum and in the course design. Furthermore since using ICT in teaching EE is considered as the new innovation, the introduction and application of new innovations in education require appropriate design and implementation of teacher training programmes (Rauch and Steiner, 2005).

The successful implementation of educational technology in schools' programmes, strongly depends on the teachers' support and attitudes. It is believed that if teachers perceived technology programmes as neither fulfilling their needs nor their pupils', it is likely that they will not integrate the technology into their teaching and learning. Among the factors that influence successful integration of ICT into teaching are teachers' attitudes and beliefs towards technology (Keengwe and Onchwari, 2008; Hew and Brush, 2007). If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes.

2.8.2 Technical Support

Access to ICT infrastructures and resources in schools are necessary conditions to the integration of ICT in education (Plomp, 2009). Effective adoption and integration of ICT into EE teaching in schools depends mainly on the availability and accessibility of ICT resources such as electrical power, internet connectivity, radios, televisions, batteries, computer hardware and software to mention a few. Obviously, if teachers cannot access ICT resources, then they will not use them. Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology.

A study by Yildirim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. Jones (2004) reported that the breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. Even though,

lack of technical support discourages teachers from adopting and integrating technology in classrooms as technical support in schools has a big role to play in influencing teachers to apply ICT in classrooms.

BECTA (2004) also confirms that if there is lack of formal technical support in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. In Ireland, the National Council for Technology in Education, (NACTE, 2015) conducted a census on ICT infrastructure and found that about 85.3% of schools reported technical support and maintenance as a ‘high’ or ‘very high’ priority and claimed that it should be an important element of the school ICT department to ensure proper technical support being made available to maintain ICT hardware and infrastructure. Similarly, Yilmaz (2011), in assessing the technology integration processes in the Turkish education system reported that in providing schools with hardware and internet connections, it is also crucial to provide the schools with technical support with regard to repair and maintenance for the continued use of ICT in schools.

Therefore, if there is no technical support for teachers, they become frustrated resulting in their unwillingness to use ICT (Tong *et al.*, 2005). A study by Korte *et al.* (2007) revealed that schools in Britain and the Netherlands have appreciated the significance of technical support to help teachers to integrate technology into their teaching. They argued that ICT support in schools influences teachers to apply ICT in classrooms without wasting time in troubleshooting hardware and software problems. Access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education (Plomp *et al.*, 2009). Effective

adoption and integration of ICT into EE teaching in schools depends mainly on the availability of and accessibility to ICT resources such as electrical power, internet connectivity, radios, televisions, batteries, computer hardware and software to mention a few. Obviously, if teachers cannot access ICT resources, then they will not use them. Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology.

Abdelwahed (2016) examines the current situation of ICT implementation at five public schools in Sudan and the barriers that prevent the implementation of ICT in schools. The findings indicate that ICT implementation at the sampled schools was poorly achieved due to, among other barriers, inadequate technical support and lack of time to implement ICT in schools. The survey of ICT in education in Sudan by Hamdy (2007) revealed that the Sudanese government formulated the national ICT strategy that focuses on the areas such as technology infrastructures, human resources development and software industry development.

According to Samia (2015), the ICT plan for education was launched in 2002 to cover the development of schools curricula, teachers' training, managing and organizing educational institutions and supporting the idea of lifelong learning. In 2004, ICT was introduced in secondary schools curricula. A number of computers were installed in schools (around 50% of secondary schools), at the average of 10 computers per school (Ahmed, 2015). However, the connectivity of internet was mainly through dial-up and ADSL at schools. Another research was conducted by Brečko (2008) to determine the use of ICT in lessons in the first triennium of Slovenia primary school, specifically in environmental studies subject lesson. The

study concluded that the use of computer in learning process is not enough due to bigger technical and other obstacles.

According to the observed lessons of the environmental studies subject, less than half of the participants in the research used ICT devices during the class observation hours. Shadreck (2009) investigated primary school teachers' perceptions of the barriers and challenges preventing them from integrating ICTs in the environmental science classrooms. The findings of the study indicated that, teachers are not yet ready to integrate ICTs into their classrooms due to a number of obstacles that include unavailability of infrastructure, equipment and web based resources in the classrooms. Also, lack of hardware and software support exists in most of the surveyed schools that deter the successful integration of ICT in lessons (Demici, 2009).

2.8.3 Management Support

The school management needs to be receptive and supportive not only to the idea of application of e-learning but also supportive to instructors and learners in different ways (Nihuka, 2013). Administrators in schools such as head teachers act as mediators to integrate technology into education system by playing a key role in encouraging, supporting and helping teachers to use computers in the teaching and learning process. The success of integrating information and technology into teaching and learning interaction depends on the support provided by the head teacher of the school (Samuel, 2006). Then the disposition of head teacher can either be a hindering factor or a facilitator for computer integration in education. Dinham (2005) asserts that leadership is important in developing effective, innovative

schools and in facilitating quality teaching and learning through computers. The role of the head teacher is crucial in providing the guidance, encouragement and conditions necessary to enhance the use of computers in the teaching profession.

The same situation is found in other East African countries. In Kenya for instance, as a result of inadequate preparation of head teachers for their new role as technology leaders, integration of computers in teaching and learning process is still not streamlined properly. Leadership in schools is important in developing effective and innovative schools and in facilitating quality teaching and learning through computers (ibid). The role of the head teacher is crucial in providing the guidance, encouragement and conditions necessary to enhance the use of computers in the teaching profession.

According to Schiller (2003), school leadership has a responsibility for initiating and implementing change through use of computers to facilitate decisions about integration of computers into learning and teaching. The vision of getting the school ready and up to date with use of computers in classroom cannot be accomplished without the commitment, willingness and readiness of head teacher. Walsch (2002) posits that technology integration could be achieved in school only if head teachers are totally committed over a period of time, actively support it and learn it as well.

The head teacher who takes an active approach and has positive disposition to innovation can foster an environment that has greater benefits for their pupils and staff. Thus efforts of integrating computer use in schools are seriously threatened unless head teachers become active technology leaders in school. Despite the fact

that the use of technology helps pupils work collaboratively and develop high-order thinking skills, there is no wide use of computers in schools (Newhouse, 2002). Diffusion of technology innovation, head teachers' attitude, disposition and concerns are indispensable to make significant changes for instructional innovation.

Though infrastructure support is imperative, school technology leadership is a stronger predictor of teachers' use of computer technology in teaching (Anderson, 2000). Yee (2000) believes that a leader who implements technology plans, also shares a common vision with the teachers to stimulate use of technology in their lessons. Schiller, (2003) suggest that for effective utilization of ICT by teachers, there is a need for a strong leadership to drive well-designed technology plans in schools. The research that was conducted on the effect of ICT on teaching in basic schools in United Kingdom also stressed on significance of good leadership (Lai and Pratt, 2004). In addition, five factors were identified as essential to be present in schools if ICT was to be utilized properly. These factors were ICT resources, ICT teaching, ICT leadership, general teaching and general school leadership. According to the report:

“Although ICT opportunities are typically provided by the classroom teachers, the quality of leadership and management of ICT in a school is crucial to the provision of good ICT learning opportunities. As the quality of ICT leadership improves, so does the percentage of schools providing good quality ICT learning opportunities” (Lai & Pratt, 2004, pp. 462).

In 2003, BECTA commissioned two literature reviews and a teacher survey to identify the factors which hinder or promote effective use of ICT by teachers (BECTA, 2003a, 2003b). BECTA (2003a) report collates evidence from a range of sources on the actual and perceived barriers to teacher uptake of ICT. Key findings

of the BECTA (2003a) report include confidence, time and access to quality resources as major factors in determining teachers' engagement with ICT; also recurring technical faults, and the expectation of faults occurring during teaching sessions, are likely to reduce teachers' confidence and cause teachers to avoid using the technology in future lessons; in addition resistance to change is a factor that prevents the full integration of ICT in the classroom.

In particular, teachers who do not realize the advantages of using technology in their teaching are less likely to make use of ICT. There are also close relationships between many of the identified barriers to ICT use, and any factors influencing one barrier are likely also to influence several other barriers. For example teachers' confidence is directly affected by levels of personal access to ICT, levels of technical support and the quality of training available (*ibid*). Thus, there is an important need to identify the significant research issues with respect to ICT use for teaching and learning.

2.9 ICT Infrastructure

ICT Infrastructure offers a range of technologies to assist organisations in running efficiently. These services are essential to the everyday mechanics of an organisation and integral to effective service delivery. A concerted effort is required to provide adequate ICT infrastructure throughout the education sector, from computers, digital equipment, telecommunications, and internet access to radio and TV (MOEVT, 2007), as well as supportive infrastructure such as electricity. The infrastructure will serve the needs of all stakeholders in education, including students, teachers, parents, local communities, administrators and managers.

Given the current lack of ICT infrastructure, the roll-out of ICT was carried out in phases, with the overall aim of nationwide coverage by 2025. From the outset, an effort was made to provide infrastructure to remote and underserved areas, using technological solutions that are suited to local needs and conditions (ibid). The ICT infrastructures include networking systems, software and hardware, such as computers, printers, digital cameras, external hard-drivers to mention a few.

2.9.1 ICT Related Policies

ICT policies in the East African Community began taking shape in the early 2000s. As noted before, there had been an increase in unregulated use of ICTs that prompted the need for governments to offer direction in the use of these technologies. However, the formation of the policies has been a long and complicated process. In Kenya, for example, the earliest known ICT policy dates back to the 1980s and by 2000 it was not yet effectively implemented (Nduati and Bowman, 2005). These ICT policies, nonetheless, were and still are comprehensive and stress access to ICT tools and internet connectivity (Farrell, 2007; Hare, 2007).

The Tanzania Ministry of Education having acknowledged the importance of ICT presided over the formulation of a more specific policy to guide the integration of ICT in basic education (MoEVT, 2007). The policy was directed at achieving the aims of Tanzania's education policies and education development programmes which emphasize the acquisition and appropriate use of literary, social, scientific, vocational, technological, professional and other forms of knowledge, skills and understanding for the development and improvement of society.

The vision of Tanzania national ICT policy is to enable Tanzania become the hub of ICT infrastructure and ICT solutions that enhance sustainable socio-economic development and accelerated poverty reduction both nationally and globally (ibid). The Tanzania Development Vision 2025 (URT, 2002) also puts a great emphasis on the use of ICT as central to competitive social and economic transformation. In spite of such emphasis, Senzige and Sarukesi (2003) point out that most schools including those that have some ICT facilities do not use them as learning and teaching tools due to various challenges.

The concept of ICT in education, as seen by the MOEVT, includes systems that enable information gathering, management, manipulation, access, and communication in various forms. The Ministry has formulated three main policies for ICT in education. The first policy is that of ICT for all learners, meaning that ICT is used as an enabler to reduce the digital gap between the schools. The second policy emphasizes the role and function of ICT in education as a teaching and learning tool, as part of a subject, and as a subject by itself. Apart from radio and television as a teaching and learning tool, this policy stresses the use of the computer for accessing information, communication, and as a productivity tool.

The third policy emphasizes using ICT to increase productivity, efficiency and effectiveness of the management system. ICT will be extensively used to automate and mechanise work processes such as the processing of official forms, timetable generation, management of information systems, lesson planning, financial management, and the maintenance of inventories (MOEVT, 2007).

EE in Tanzania began to be taught as far back as 1960s where the content of EE started to be slotted in the Tanzanian school curriculum. There were components of EE in the subjects of domestic science, agriculture, science and geography (O-saki, 1995). To date, the issue of EE also features very clearly in the Tanzania Education and Training Policy that was issued in 1995. The policy states clearly that one of the objectives of EE in Tanzania is to enable a rational use, management and conservation of the environment (MoEVT, 1995). Being one of the countries affected by environmental degradation, Tanzania responded to the need for EE by including EE in the PSC at all levels since 1990s.

Following the amendments of PSC in 1997 the subjects with EE notable components include social studies, science, vocational skills, personality and sports, and language (English and Kiswahili). In Tanzania currently the legislation pertaining to environmental governance is the National Environmental Management Act Number 20 of 2004 which specifically addresses the management of hazardous waste under part IX. Concurrently, from education point of view, there is a necessity to have education for awareness, raising and finding solutions for the environmental issues in the country.

As future professionals, primary school ICT pupils have the potential to contribute towards the development and enactment of the relevant legislation in this area. Similarly, as technical experts, ICT pupils have the potential to review any existing laws and make relevant suggestions for amendments (Magashi, 2011). It is envisaged that an inspirational and innovative school based environmental programme that has been successful in integrating EE across the curriculum,

reaching beyond the classroom to the whole school community and beyond the school community to the broader community, is of vital importance.

2.9.2 Physical ICT Infrastructure

ICT infrastructure plays a critical role in telecommunications systems, providing the physical link between sources and destinations of information. Infrastructure systems range in size from small and simple, linking just a few nodes, to large and complex, linking several buildings with tens of thousands of nodes. Investment in ICT infrastructure, such as broadband rollout, is a vital step to promote economic development and social integration (European Commission, 2001). However, the investment must include a clear focus on ICT teachers' skills development to ensure that the maximum potential is extracted from the infrastructure once it is put in place.

The cabling system provides the physical link between active network equipment such as routers and switches, and the terminal equipment such as computers and telephones. The design and installation of any wireless LAN (WLAN) access points will generally be carried out by the school's ICT systems provider and is not considered to be a part of the structured cabling system. As physical infrastructures become more sophisticated and loaded to capacity they become more interdependent and rely more on ICT (ibid).

2.10 ICT Teachers' Training

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies are demanding teachers to

learn how to use these technologies in their teaching. While new technologies increase teachers' training needs, they also offer part of the solution. ICT can provide more flexible and effective ways for professional development of teachers, improve pre- and in-service teacher trainings, and connect teachers to the global teacher community (Perraton et al., 2001). The use of ICT in teaching and learning as well as administration and management represents a powerful tool with which to achieve educational and national development objectives (MoEVT, 2007). The ministry has therefore formulated the ICT policy to guide the integration of ICT in basic education.

On the other hand, in August 2005, the government of the United Republic of Tanzania in collaboration with the Swedish Government through the Swedish International Development Cooperation Agency (SIDA) initiated a project for introducing ICT in all government teachers' colleges. The project's main goal was to improve the quality of pre-service and in-service teacher education by using ICT. In this project the principals of the teachers' colleges, tutors and student' teachers were trained to be able to use ICT as a tool for teaching and learning as well as for management and administration (ibid). It was envisaged that the benefits of preparing ICT literate teachers will spill over to schools when implementing initiatives like e-school or e-Learning. The teacher training programme formed the first phase of the implementation of the sector-wide implementation of ICT in education.

2.10.1 In-Service Teachers' Training Approaches

The study that was conducted by Mwalongo (2011) found that the level of teachers'

competence in employing ICT in teaching and learning process was found to be influenced by computer training whose duration ranged from two weeks to six months. The study revealed that 48.4% (36) of the teachers got training from former teacher training colleges and schools, 15.4% (11) from private computer centres, 3.8% (3) self-taught and 3.8% (3) taught by friends, while 28.6% (21) did not receive any training at all (ibid).

The respondents who had received some form of computer training displayed more competent use of ICT in various areas than those who did not receive any training. Training modes, contents and methodologies have to go on changing, so that trainees may be more deeply implicated in the definition and organisation of their training achievements. Assisted training modes must be articulated and complemented by distance training experiments, supported by online tools, such as practice communities, where trainees may find supporting materials and communication devices, to provide the share of ideas, materials and the interaction with other teachers. The lack of computer training could lead to cyber phobia that according to Agbatogun (2013) is likely to limit the teachers' use of ICT. The following are some of the in-service teachers' approaches that may be used for ICT training:

The Workshop or Observation/Assessment approach where by an ICT specialist observes teachers in their classrooms, assessing their instructional practices and providing structured feedback. The workshop approach is mainly used by most of the training sessions in Tanzania ICT trainings. During workshops, teachers may spend the middle two days of the workshop creating and modifying a learner centred activity that uses ICT. They pilot it with colleagues on the final two days of the

workshop. They receive feedback from peers who are provided time to refine the lessons. Based on the feedback, teachers implement the refined lessons upon return to their schools (Knight, 2007).

Open lesson approach where the teachers create lessons and invite colleagues to observe the lesson and provide feedback in a post-observation session. Open lessons can help teachers develop basic, intermediate, and advanced ICT skills. In lesson study, teachers collaboratively plan, develop, or improve a lesson; field test the lesson; observe it; make changes; and collect data to see the impact of the ICT lesson on student learning. In contrast to open lessons, where the focus is on teachers' action, the lesson study approach focuses on students' actions.

In design teams' approach teachers collaborate, as a single large group or in smaller teams, to solve a common problem or create and implement a plan to attain a common goal. During the collaboration process they may use ICT resources or other classroom materials (such as work created by students) and their experiences, as part of their approach to the problem. Dogan (2010) points out that, teacher training in ICT is vital for future conception and uses of computers for teaching and learning process.

In the Inquiry (Action) Research approach, teachers form teams based upon a common interest and select an issue, investigate and research it, plan for possible actions to remedy it, take action, observe and document results, reflect on outcomes, and create an action plan to address this issue. While Study Groups are broader in their focus, Inquiry Research tends to be more focused on issues related to

instruction. Inquiry Research involves the use of higher order skills (researching, synthesis), a more surgical instructional approach (targeting areas of instructional difficulty), a good deal of teacher time, and if ICT is used, more advanced computer applications (spread sheets, databases, and possibly statistical software packages). It is most likely useful for teachers who already have advanced skills (Hammond, *et al*; 2009).

In a mentoring approach, older or more experienced teachers guide and assist novice teachers in all areas of teaching. Mentoring can be structured as a one-to-one approach, or as a many-to-many approach in which several mentors and less experienced teachers work together as a team. Mentoring is one of the most important model and the best practice in teacher professional development. Mentoring is also popular among teachers because it provides recognition, builds on their experience, aspirations, and it helps promote confidence (*ibid*). In addition mentoring helps to reduce anxiety and can keep teachers from trying new approaches in their classrooms.

2.10.2 Teachers' Support During Training

Various research studies have shown that more than half of the educators had been exposed to one form of ICT training or the other. But trainings had hardly included the use of ICT in instruction (Jegede, 2009). Most of those trained educators received their training directly from the institution. Educators preferred mostly the inclusion of software skills on teachers' ICT training curriculum. The problem has been that these trainings don't impact the integration of ICT into teacher educators' classrooms (*ibid*). Even after ICT training, teacher educators in few cases use ICT

facilities such as internet and computers for word processing. Thus teaching with ICT in schools still becomes impossible to achieve.

The most critical factor in the successful integration of ICT into education is the extent to which teacher educators are able to prepare teachers with the required knowledge and skills to utilize ICT effectively (ICT in Education, 2006). Student teachers need to experience models of ICT use in their own learning before they can go ahead to implement same in their later profession. Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change (UNESCO, 2002).

In the first phase of in-service training in Tanzania, ICT teachers' training that was conducted in teachers' colleges; all thirty four governmental colleges received thirty client computers and a server including peripherals and accessories. The project was completed in 2008 and has since become a programme of MoEVT (MOEVT, 2007). The funding for the teachers' colleges is currently from the government through the recurrent budget allocation. Thirty of the teachers' colleges are connected to the national electrical grid and four of the colleges use generators and solar panels.

Alongside with SIDA training and for the purpose of minimizing the cost of training as well as increasing the number of enrolment in these courses, Agency for Development of Educational Management (ADEM) has developed online-training programmes for training education cadres in the regions. The online training was officially inaugurated in July, 2007 (<http://www.adem.ac.tz>). The agency is also developing training programmes using video that also help disabled learners (ibid).

Other scholars, (Mathew, 2012; Fiszer, 2004; Granger, 2002) have conducted the studies and found that most of the in-service ICT teachers' training programmes in some countries were conducted mainly after school hours or during holidays. Additionally, teachers also complained about having to make their own way to training sessions traveling to the central location sometimes without financial assistance from the education system (Nawal, a computer lab coordinator, February 28, 2007) making training courses a burden on teachers.

In addition, as teachers are expected to implement skills that they develop from ICT training in classrooms, training should ensure a direct link between these skills and their implementation in real teaching environments. Trainings that lead to learning isolated skills can have little impact on classroom practices if training courses do little to help teachers to transfer these skills to classrooms. Participants in ICT teachers' training expressed their frustration about both the physical environment such as crowded rooms and the quantity of machines as the numbers of computers to exercise the taught skills were not enough. Furthermore, participants commented on the mentors' availability to provide follow-up for teachers. Motives and incentives for teachers who undertake ICT professional development programmes are identified in the literature as a supporting factor for ICT professional development (Shuldham, 2004; Downes, 2001).

Santos and Ponte (2003) suggest that there should be experiments supported by online tools such as practice communities where trainees may find supporting materials and communication devices, to provide the share of ideas and materials and the interaction with other teachers. It's important that training institutions allow

equipment to be available for trainees, after formal training, and it's also quite necessary to have supporting teams to prepare and attend to the first experiments with ICT in the real classroom situation. It is considered urgent to overcome the barriers concerning the lack of skilled staff of technical support in training institutions and schools. It is also important that training institutions allow equipment to be available for trainees, after formal training, and it's also quite necessary to have supporting teams to prepare and attend to the first experiments with ICT in the field.

2.10.3 Teachers' Perceptions about Training

Most of the teachers report that they have not had adequate training to prepare themselves to use technology effectively in teaching and learning. Mwalongo (2011) made a study with regard to "Teachers' Perceptions about ICT for Teaching" and found that majority of teacher trainers felt that ICT was quite an important tool for their own development and studies, a tool for preparing classes, a tool for finding materials for preparing classes and for use in specific concepts and skills. The results indicate that while the frequency of using ICT was influenced by access, the competence of ICT use was influenced by training; teachers used ICT in a wide range for teaching, administration, professional development and personal use. However, teachers did not use ICT to radically change their pedagogical practices, but rather to sustain their traditional practices.

UNESCO's founding statements about EE in the 1970s positioned it as a multidisciplinary field of inquiry. When enacted as such, it challenges traditional ways of organising education by academic subject areas and suggested that EE

requires various forms of integrated and project-based teaching and learning approaches. These can involve hands-on experimentation alongside the retrieval and critical analysis of information from diverse sources and perspectives, and with different qualities and statuses. The review calls for further studies that will provide models of productive forms of teaching and learning that harness ICT resources, particularly in developing the goals and methodologies of EE in the twenty-first century.

Gulbahar and Guven (2008) on the other hand made a survey on ICT Usage and the Perceptions of Social Studies Teachers in Turkey and found that the groups that sometimes and frequently use computer related tools in the classroom have a higher level of expertise than the groups that never use them. In other words, teachers who have a high level of expertise tend to use computer related tools in the classroom more frequently than the others. Also the findings of the study indicated a very strong positive correlation between teachers' attitudes toward ICT in education and their perceptions of the advantages of the use of computers. However, teachers' perceptions of the compatibility of ICT with their current teaching practices were not as positive. Teachers pointed out that the class time is too limited for ICT usage. Hence, the introduction of ICT innovations into education requires promoting structural, pedagogical and curricular approaches. This conclusion points out to the need for considering also the cultural factors in studies conducted in developing countries (Albrini, 2006).

Developing countries are vitally dependent on substantial foreign assistance to ensure the development of ICT. However, it is often very difficult to persuade

donors to focus on ICT. These countries are perennially short of foreign exchange to acquire the latest technologies. Developing countries have to ensure that the technology that is adopted is easily accessible to the target group and also fulfills all the functions that are expected of it. Such a scenario essentially implies that a costly technology need not always be the best technology. However, it is often seen that developing countries invest in the latest technologies without considering whether the target audience can be reached effectively or whether the target audience is interested in the technology (Usun, 2004).

Also another study identified the other main barriers to the implementation of ICT as perceived by the teachers as the mismatch between ICT and the existing curricula and the class-time frame (Abdelwahed, 2016). Teachers suggest that placing ICT in schools is not enough to attain educational change. The introduction of ICT into education requires equal level of innovation in other aspects of education. Both policymakers and teachers share this responsibility. Policy-makers should provide additional planning time for teachers to experiment with new ICT-based approaches. Teachers' preparation necessitates not merely providing additional training opportunities, but also aiding them in experimenting with ICT before being able to use it in their classrooms. Therefore, if decision makers want to involve teachers in the process of technology integration, they need to find ways to overcome the barriers perceived by the teachers.

2.10.4 Teachers' Learning from the Trainings

Education is more engaging towards ICT than before. Therefore, after the ICT training teachers get skills and knowledge that assist them to use ICT not only in the

classroom, but also as a way of developing themselves further. However, teachers' willingness to use ICT resources and their existing potentials are facing problems due to inaccessibility of ICT resources and lack of in-service training opportunities after the initial ICT training (Gulbahar and Guven, 2008). The ICT training has improved empowerment a lot among the teachers who felt more empowered by their participation in the project, inspired others since participating in the training gained useful computer skills, more self-confidence, more involvement in decision-making at their schools, use the computer for other purposes as well as accessing e-mail address which helps teachers to research the lessons they are teaching. Teachers need to prosper in the future and add more productivity in the classroom while also working harder than they did before they participated in the project (ibid).

The other opportunities for ICT teachers' training are the ones most likely to transform modes of learning and educational service provision. After training, teachers bring a new technology in their classrooms and model the learning process for pupils while at the same time gaining new insights on teaching. McCormick and Scrimshaw (2001) argue that in this way ICT can make some aspects of teacher pedagogy more efficient, and that it also has the potential to extend and transform the process of teaching and learning itself. From the analysis of how pupils access information, what use they make of it, and how they interact with instructional systems, feedback loops that respond to different pupils' needs and capabilities can be developed.

The practical difficulties of creating useful formative data, and linking this to adaptive learning systems that are responsive and result in valued learning outcomes,

may be quite formidable. The choices of appropriate teaching and learning of EE is dependent on a range of factors such as the curriculum or course objectives; the purpose of the teaching and learning, the educator's preferred teaching approach, the learning styles of the learners and the nature of the curriculum content. Although we advocate that teachers should use the teaching approach that suits their paradigm of teaching and learning of EE, we believe that the use of educational technology provides teachers with opportunities for traversing an entire continuum of possibilities as may be appropriate to their teaching needs. Educational technology creates affordances for a range of different teaching and learning activities which the teacher may not have used or considered (Majumdar, 2006).

2.10.5 Teachers' Use of Acquired Knowledge

In EE teaching process, a teacher can use the computer and other ICT instruments in different parts of the lesson. He can use it as an instrument for introducing new contents or for consolidating what is already known. According to research status and trends of ICT use in Slovene primary and secondary schools, primary school teachers felt that ICT use had the most positive effect on teaching and learning process (Vehovar, 2008). In any case, the use of ICT requires thoughtful planning, appropriate selection of ICT tools and developing new teaching strategies from the teacher. According to UNESCO (2004), the three main approaches to ICT taken by teachers are:

An integrated approach: planning the use of ICT within the subject to enhance particular concepts and skills and improve learners' attainment. An enhancement approach: planning the use of an ICT resource which will enhance the existing topic

through some aspects of the lessons and tasks. A complementary approach: using an ICT resource to empower the pupils' learning. All the three approaches can enhance attainment, but the effects may be different. In the integrated approach, pupils' learning is enhanced because they are confronted with challenges to their existing knowledge and given deeper insights into the subject being studied. The enhancement approach presents knowledge in new ways, encouraging pupils to formulate their own explanations. In addition, the complementary approach frees the pupil to focus on more challenging and subject-focused tasks (ibid).

These different types of use require the teacher to have an extensive knowledge of ICT and to be able to fit its use either into their existing pedagogy or to extend their pedagogical knowledge so that they can accommodate ICT effectively in their teaching. Finally, ICT initiatives need to be driven by the provision of appropriate technological solutions for the challenges faced by communities rather than by an interest purely in these physical technologies themselves, particularly in countries where resources are limited. Those implementing technological solutions need to ensure that they are sustainable, context-specific and adapted to local needs and conditions. It is only when potential users have a sound understanding of how they can use new ICTs effectively that they have real influence. Otherwise, ICT becomes just a drain on the organisation or community (Unwin, 2005).

2.11 Teachers' Effectiveness in Teaching and Learning

Available literature illustrates that for effectiveness of ICT in enhancing the teaching and learning of EE, instructional practices to teachers need to be improved in order to enhance the pupils' learning as explained hereunder.

2.11.1 Instructional Practices

Teachers believe that ICT is an important tool for both pedagogical and administrative purposes. Teachers and pupils feel less confident about the pedagogical use of ICT for learning purposes. There is hardly any regulation or mandatory standards that guarantee a certain level in the preparation of all student teachers in the use of ICT by well-prepared teacher trainers (Swarts and Wachira, 2010). Therefore the use of ICT in schools' instructional practices particularly in developing countries like Tanzania is very limited.

ICT is considered an important tool in teaching and learning. However, the implementation of ICT faces several infrastructural and personnel challenges. They include schools with limited ICT facilities, costly internet access, limited information sharing, limited skills for ICT integration, to mention a few (Mendes *et al.*, 2003), limited electricity supply, fixed telephone networks and number of computers, limited awareness or use of computers (Hesselmark, 2003), lack of policy framework, inadequate infrastructure and cost of bandwidth, and inadequate in-service training on ICT integration in education (Hare, 2007). Mendes *et al.* (2003) point out that there is less emphasis on ICT training in primary and secondary schools in Tanzania due to limited resources.

2.11.2 Pupils' Learning

Pupils' always look for flexibility in time, space, place, content selection and delivery of instructions. It was quite impossible to satisfy such requirements in earlier times due to the non-availability of proper tools. It is now feasible and possible to implement open and flexible learning strategies using ICT as tools.

Flexible access to content and learning resources via network across conventional class rooms, homes and community centres is the defining characteristic of what has come to be known also as distributed learning. Learning anytime, anywhere with synchronous and asynchronous communication across space, time and pace is the key to web based instruction (Majumdar, 2006). With availability of online tools, it is now possible to create content websites, online education to support and assist face to face instruction in an innovative way. Communication with e-mail, searching for information, locating a proper website is now the key to success. Searching, locating and categorizing knowledge and information via internet have opened new vistas in implementation of flexible learning strategies.

Therefore, preparation of teachers to face the challenges of an ICT enriched learning environment is crucial. Teachers need to be equipped with fundamentals of ICT tools as well as orientation towards changing mind set and developing positive attitudes towards ICT application in enhancing learning. Understanding the changing role of teachers from instructors to facilitators, teacher-lead instruction to learner-centred instruction is the key for successful implementation of pedagogy-technology integration for enabling pupils' learning (ibid).

2.12 Pupils' Reactions about the Use of ICT in EE Teaching and Learning

The integration of ICT can promote significant changes in the practices of teaching and learning (Blackmore et al, 2003). The use of ICT during EE teaching process has a great impact on pupils' learning. Keeping the importance of ICT in view, teachers should make maximum use of ICT during EE teaching process because it has a great impact on pupil's learning. Ozoemelem (2009) strongly recommends that pupils

should be trained to use advanced searching techniques for retrieving the materials of their interests as majority of pupils use internet for study but they do not know about advanced searching techniques.

Further, various studies have reported that majority of the pupils have been facing the problems of slow speed of PCs due to viruses, inadequate number of PCs in labs, lack of time in utilizing e-resources, slow internet connectivity and electricity failure (Ndinoshiho, 2010; Swain, 2010; Ozoemelem, 2009). Effective use of ICT impacts on learners' various aspects of the learning process as follows: ICT increases learners' motivation and thus enhances personal commitment and engagement; ICT also improves independent learning and learners' collaboration and communication. As mentioned previously, the effects of ICT depend on the way it is used; the key-word being "effectiveness", the main question being how can ICT be used effectively to support the learning process.

One way of promoting knowledge as design is to use computers as cognitive tools. With cognitive tools, information is not presented in the educational materials to be learned. The roles of learners are those of designers and problem-solvers. Learners use the computers as cognitive tools to access, analyse and organize their personal knowledge. This approach enables learners to think deeply and to perform their learning tasks effectively (Jonassen, 2000; Reeves, 1999). To be able to use technology as a cognitive tool, it is important to provide an appropriate learning context for the learners. Yaghoubi *et al.* (2008) conducted a study about the students' perception of e-learning in Iran and found out that although there are shortcomings with regard to students' competency of e-learning, access to internet, computer and

internet usage and assessment; students have positive perception towards e-learning.

Deaney *et al.* (2006) investigated the “Pupils’ Perspectives on the Contribution of ICT to Teaching and Learning” and found that pupils saw computer-based tools and resources as helping not just to effect tasks and improve presentation, but also to refine work and trial options. They associated the use of such tools and resources with changes in working ambience and classroom relations, as well as with raised interest and increased motivation on their part. Finally, while pupils welcomed opportunities for independent working mediated by ICT in which they could engage more directly with appropriately challenging tasks, they were concerned that this reshaping of learning might be displacing valuable teaching (ibid).

Since this is the era of ICT, to perk up educational planning is indispensable in implementing the ICT in education sector. Learners can perform well throughout the usage of ICT. ICT helps the learners to augment their knowledge skills as well as to improve their learning skills (Nisar, 2011). Analysis of video data also showed that pupils can work with ICT for long periods of time, investigating their own questions and experimenting with ideas in an interactive way. However, pupils need to be guided properly as some pupils may engage with ICT to learn things that are at odds with what the teachers intend.

2.13. Effectiveness of ICT Teachers’ Training

Many factors contribute to effective adoption of e-learning in education some of them being students’ knowledge, skills and perceptions of new technologies (Nihuka, 2013). It is envisaged that effective training is not enough to get teachers

start using technology in education. There is a need to have pedagogical support, technical support and other form of support from the management so that instructors are able to design and develop their courses, deliver content and design the student's activities (Fisser, 2001; Bates, 2008).

It is noticed from literature that teachers have varied range of knowledge, skills and perceptions about technology use for educational purposes. For effective training, the curricula may have various representation such as intended curriculum, referring to both the policy ideals and vision, or philosophy underlying a curriculum (ideal curriculum), implemented curriculum, comprising both the curriculum as viewed by teachers (perceived curriculum) and the actual process of teaching and learning in the classroom (operational curriculum); attained curriculum, addressing both learning experiences (experiential curriculum) and learning outcomes (learned curriculum) (ibid).

Existing literature identifies the characteristics which make training effective to include a systematic process to determine who needs to be trained (training needs assessment), identify and communicate purpose, objectives and outcome, relevant content directly linked to trainee job experiences, active demonstration, opportunities for practice, regular feedback during training and post-training environment where teachers are given opportunities to perform the skills they've learned. If the post-training environment does not support this, studies have shown that training will have little to no impact on trainee performance and organizational utility (Noe, 2010).

2.14 Empirical Studies Related to this Study

Limited studies were found to indicate countries where related research with regard to ICT and environmental issues were conducted. Some of these studies are here under explained.

United States of America: In 2003, USAID conducted a research to identify the use of ICT for EE and Youth Empowerment in Lebanon. Approximately four hundred students from schools across Lebanon and an Egyptian delegation made presentations on twenty seven projects and participated in discussions about environmental protection. The conference became truly international when participants held live discussions with YouthCaN New York and delegations from Morocco, India and Lebanon via videoconferencing technology. Topics included landmine awareness, pesticide use, recycling, wastewater treatment, deforestation and silkworm art. Students also shared information about their use of telecommunications and other technologies in local, national and global environmental projects (USAID, 2003). These youth became environmental leaders.

In the months leading up to the conference, students held an environmental rally, prepared presentations and exchanged ideas with youth from other communities. The project used ICT to support education that is activity-oriented and stimulates a desire to learn and act locally. They learned how to post content online, develop power point presentations and discuss environmental issues in class and in online discussion groups. These skills enabled them to continue working on environmental issues in their own communities (USAID, 2003).

Slovenia: Another research was conducted by Brečko (2008) to determine the use of ICT in lessons in the first triennium of Slovenian primary schools, specifically in environmental studies subjects. Based on the answers of the surveyed teachers, the study concluded that the use of computers among teachers in the first triennium of primary schools was not encouraging. Teachers otherwise use the computers but they do not include it enough into the teaching and learning process due to bigger technical and other obstacles. The frequency of computer use in particular subjects indicates a positive trend, at least what concerns environmental studies subject.

The key factor of a success of this kind of education is the teacher who has to assume the modern ICT and through that opening the new possibilities in the teaching process that make the lesson more effective and interesting. But according to observed lessons of the environmental studies subject we can see that less than half of the participants in the research used ICT devices during the class observation hours of environmental lessons. Teachers that were using ICT devices during students' observation hours most commonly decided for the computer. In the extent that they used any other interactive learning materials during these lessons, results show minor differences which are however connected to a particular grade. Teachers were observed teaching through the assistance of CD's or DVD's in the elementary grade and in the advanced grade they used web pages or in broader sense the internet (ibid).

Saud Arabia: Mulhim (2013) made a study to investigate the overall focus of ICT in primary schools in Saudi Arabia, in particular the use of ICT by novice female primary school teachers. This represented the first phase of a study that aimed to

discover whether a tailored training program might help teachers to widen and improve their use of ICT, and thus to improve their pupils' results. The study found out that the current use of technology in Saud Arabia is very low. The reasons behind this could include lack of access to technology, lack of training, and lack of time.

Furthermore and despite the positive comments they made on their training, teachers expressed the view that it did not become clear how new technologies could support better their teaching. It seems that this blurring about the functionality of new technologies is believed to be one of the drawbacks of teachers' training in ICT especially in developing countries, since teaching in these programmes cannot link theory and teaching practice effectively (Politis, 2000). Teachers consider the use of ICT in these training programmes as more mechanistic and meet the needs neither of the modern school nor of the teacher, who should form a citizen with critical thought through educational procedures and processes. The study was finalised by a conclusion that, only a small percentage of teachers do not believe in the suitability and the success of training they got related to informatics. In the other research it becomes conspicuous that, as a result of their training, teachers make use mainly of other basic computer programs and almost no programs that have been designed for the use in educational frameworks (ibid).

Hongkong: In addition, Wong and Li (2008) conducted a study on factors that influenced transformational integration of ICT in eight schools in Hong Kong and Singapore. The study revealed that leadership promotion of collaboration and experimentation and teachers dedication to learner-centred learning influenced

effective ICT transformation. It was also found that transformational leadership with qualities of identifying and articulating a vision, promoting acceptance of group goals, providing individualized support, offering intellectual stimulation, providing an appropriate model, creating high performance expectations, and strengthening school culture could influence the integration of ICT.

On the other hand Yuen (2003) investigated the ICT implementation and leadership in Hong Kong by conducting a case study of eighteen schools in Hong Kong. The study found out that teachers felt constrained by what they referred to as the overfilled curriculum and believed that curriculum change needed to occur in order to make room for new opportunities and new ideas to explore different ways of working. The study suggested that the priority should be to ensure that learners attain the academic level required to gain a good passing of the existing examination system in order to achieve good examination results. According to the study, if a teacher cannot make good use of ICT to help improve learners' examination results, it is better not to use ICT at all.

The findings suggest that a shift to learner centred approaches to teaching and learning is dependent not only on the introduction of ICT but also on changing the curriculum and the exam orientated educational culture that exists. They found that in catalytic integration model schools, the school principal is the key change agent, exhibiting visionary leadership, staff development and involvement. In cultural innovation model schools multiple leadership is exhibited where the school principal is not necessarily involved in ICT leadership, and teachers are free to implement new ideas in supportive and enhancing culture (ibid).

Taiwan: Lin (2011) made a study to analyse the development of the course “Education for Environmental Sustainability” by using the Learning Content Management System (LCMS) in National Taiwan University of Arts (NTUA) E-learning platform. The National Taiwan University of Arts developed the NTUA E-learning platform system in 2008 and application of the platform gave many benefits for both teachers and students. The course was an outgrowth of blending learning, which is the integration of classroom learning and electronic learning. The course development theory was based on the process of five stages: A (Analysis), D (Design), D (Development), I (Implement) and E (Evaluation). With students as the end users, the system was designed in a student-oriented way. The learning achievement of NTUA students originated mainly from presenting their individual talent such as their artwork pictures or performance videos. Hence, the students’ performance talent and comments was significant references for future development of e-contents, e-services, and e-technical in art universities.

The study earmarked many advantages for the students and instructors in teaching. In the study it was found out that e-learning was the solution for searching information since the students and instructors get lots of environmental topics and information through e-learning. Also it was found out that the use of e-learning platform will help to update environmental information at any time and using the e-learning platform to make up even when the students are out of school (ibid).

Tehran: On the other hand, Afshari (2009) conducted a study by distributing questionnaires to thirty heads of institutions in Tehran. The study ended by concluding that transformational leadership could help improve the integration of

ICT into teaching and learning processes. Furthermore studies have shown that various levels of leadership such as principal, administrative leadership and technology leadership influence successful use of ICT in schools (Anderson and Dexter, 2000). These aspects of leadership will help the principal to share tasks with subordinates while focusing on the adoption and integration of technology in the school. Institutions exemplified by executive involvement and decision-making, strengthened by ICT plan, effectively adopt ICT integration curriculum.

Algeria: Houcine, (2011) made a study in Algeria and found that the introduction of computers and the internet in language teaching is nowadays largely agreed that it impacts positively on the learning process. The way in which ICT was used has witnessed various changes through years in order to answer more specifically language learners' needs. On the other hand, Hennessy, et al (2003) made a study and found that both English and Science teachers regarded the information that can be obtained via the internet as being more up to date and broad-ranging than conventional library resources. ICT use serves to broaden reference, reduce laboriousness and increase efficiency, improve pupils' motivation and the quality of work, and facilitate learning.

Sudan: Abdelwahed (2016) examines the current situation of ICT implementation at five public schools in Sudan and the barriers that prevent the implementation of ICT in schools. The study adopted the quantitative method where a sample of five secondary schools was selected. A total of forty secondary school teachers responded to the designed questionnaire. By using Statistic Package of Social Science (SPSS), the data was analyzed. The findings indicate that the ICT

implementation at the five secondary schools was poorly achieved, and school teachers still have not acquired the necessary skills of ICT that enable them to implement ICT in classrooms. Further, the lack of financial support, insufficient existence of computer labs, low internet connectivity, inadequate technical support and lack of time were main barriers that prevent the implementation of ICT in schools.

In Sudan, the government recognized the role of implementing ICT in schools which is seen through the government's national ICT plan that cares a lot for implementing ICT schools. According to the survey of ICT in education in Sudan by Hamdy (2007), the Sudanese government formulated the national ICT strategy that focuses on the following areas: Technology infrastructures, Human resources development, Software industry development, Content (Arabic reservoir), and Geo-information. According to Samia (2015) the ICT plan for education in Sudan was launched in 2002 to cover the development of schools curricula, teachers' training, managing and organizing educational institutions and supporting the idea of lifelong learning. In 2004, ICT was introduced in secondary schools curricula. A number of computers were installed in schools (around 50% of secondary schools), at the average of 10 computers per school (Ahmed, 2015). However, the connectivity of internet was mainly through dial-up and ADSL at schools.

Zimbabwe: Shadreck (2009) investigated primary school teachers' perceptions of the barriers and challenges preventing them from integrating ICTs in the environmental science classrooms. The study adopted a qualitative research approach that is in line with the phenomenological perspective as it sought to acquire

knowledge through understanding the direct experience of others by engaging with participants through semi structured interviews and classroom observations. The participants of this study were 14 primary school teachers in Zimbabwe who were purposively sampled based on qualities like class level, working experience and gender.

According to the findings of the study primary school environmental science teachers are not yet ready to integrate ICTs into their classrooms due to a number of obstacles that include unavailability of infrastructure, equipment and web based resources in the classrooms. Teachers also lacked competence, in service training and technical support, as well as technological pedagogical content knowledge on how to integrate ICTs into teaching and learning of environmental science. Teachers' education programmes should therefore adequately prepare new teachers and equip them with skills and pedagogical skills necessary to integrate ICTs into their teaching. The study recommends that government forms partnerships with public and private sector to enable internet access, affordability, connectivity and coverage for all schools.

Uganda: Guma (2013) investigated factors influencing the use of ICT to make teaching-learning effective in Uganda higher institutions of learning. The use of ICT in teaching-learning process in Uganda is a relatively new phenomenon and it has been the educational researchers' focus. The effective integration of this technology into classroom practices poses a challenge to teachers and administrators. This empirical study aimed at finding out the factors influencing the use of ICT to make teaching learning effective in higher institutions of learning in Uganda and

identifying the innovations that ICT has brought into teaching-learning process, particularly in higher institutions of learning in Uganda. A survey was employed in order to empirically investigate the study. The findings of this study revealed that teaching staff and administrators had a strong desire to integrate ICT into teaching-learning processes.

The innovations that ICT has brought in teaching learning process include: e-learning, e-communication, quick access to information, online student registration, online advertisement, reduced burden of keeping hardcopy, networking with resourceful persons, to mention a few. However, the presence of all these factors increased the chance of excellent integration of ICT in teaching-learning process. The study recommended that, the training of teaching staff in the pedagogical issues and administrators in administration should be increased if teachers and administrators are to be convinced of the value of using ICT in their teaching-learning process and administration.

Tanzania: Research studies in Tanzania show that teachers use ICT in classroom teaching and learning (MoCT 2003; Foundation 2007; Tilya 2007; Swarts and Wachira 2010), however, it is evident that ICT is rarely used as a teaching learning tool (MoCT 2003; Senzige and Sarukesi 2003; Unwin 2005). Furthermore, research does not indicate how ICT is used for administration, professional development and personal purposes amongst teachers. The importance of ICT in these areas cannot be ignored. According to Cavas (2009), personal success of using the technology can encourage teachers to use the technology in other areas such as teaching and learning. However, factors such as access and cost may be some of the factors that

may limit ICT integration in schools. Despite the presence of such ICT facilities in the schools, few teachers use them as learning and teaching tools. (MoCT 2003) and Unwin (2005) points out that in some schools the facilities are not used at all.

From empirical studies there is little doubt that limited studies have been conducted with regard to effectiveness of ICT training programmes particularly in enhancing the teaching and learning of EE. In USA for instance a research was conducted to identify the use of ICT for EE and Youth (USAID, 2003); in Slovenia, the use of ICT in environmental studies in primary schools (Brečko, 2008); in Saud Arabia, the use of ICT facilities by teachers (Mulhim, 2013); in China and Singapore, the transformational integration of ICT in schools (Wong and Li, 2008); to mention just some of the studies.

2.15 Research Gap

Therefore, from the literature review and empirical studies, the effectiveness of ICT training programmes that enhance teachers in teaching and learning process have been less investigated in few countries. In Tanzania there are related ICT studies which are however, not directly related to effectiveness of ICT training programmes. Despite the fact that the effectiveness of ICT training programmes to teachers has some notable challenges in enhancing the teaching and learning of EE, still limited studies have been conducted in this area. Schools are expected to provide and extend environmental knowledge and to act as model to the local surrounding communities where as teachers and pupils in these schools are expected to be environmental experts in their surrounding communities. Given the magnitude of environmental

problems in various places, it is anticipated that EE through the use of ICT, would have contributed to the environmental knowledge to the pupils particularly of the primary schools and therefore to sustainable use of the environment to the community level and the public at large.

Research findings from various scholars; ASEE (2009), Bolstad (2004), Brown (2003), Kateka (2010), Kimaryo (2011), Magashi (2011), McLean (2003), Mtaita (2007), Spiropolous et al (2007), Thomas (2004), Van Petegen et al (2007), to mention but only some of the studies, reveal that EE in general and the ICT in particular have been difficult to implement not only in Tanzania but even in other countries. The issue of environment particularly the enhanced teaching and learning of EE through the use of ICT is still calling attention for any serious educator to conduct further studies. This study addresses these concerns with an attempt to fill the gaps addressed in other studies. Since many studies in ICT have not focused in EE, this study therefore specifically investigated the effectiveness of ICT teachers training programmes in enhancing the teaching and learning of EE.

2.15 Conceptual Framework

In this study, the conceptual framework as modified from Guskey (2000) showing the relationship of various levels with regard to teachers' professional development (Figure 2.1) was used as a conceptual framework to investigate the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in selected primary schools. A conceptual framework is a network, or a plane, of interlinked concepts that together provide a comprehensive understanding of a phenomenon (Jabareen, 2009).

Principally, ICT teachers' training programmes in enhancing teaching and learning of EE are influenced by the characteristics of the training programmes. On the other hand the trainings are influenced by the challenges and opportunities encountered by teachers and pupils in the current ways of teaching and learning of EE and the strategies to be introduced for mainstreaming ICT in primary schools. All these variables lead to effectiveness of ICT teachers training programme in teaching and learning of EE in primary schools. The key indicators to measure the effectiveness of training include relevance of the ICT contents covered in EE teaching and learning, teachers' acquiring of ICT skills and knowledge to enhance competence in EE teaching and learning, teachers' use of ICT knowledge in teaching and learning of EE, organization support to teachers after the training and learners' reactions about the new ways of using ICT in learning EE.

Guskey (2000) puts forward the five critical levels of professional development evaluation model. The levels include teachers' reactions about the educational training, teachers' acquisition of new intended knowledge, teachers' use of knowledge in teaching and learning, organization support to teachers after training and learners' reactions about the new ways of learning. However, apart from having reliable knowledge in integrating ICT in EE, teachers also need adequate resources, ongoing ICT training, and ongoing support for facilitating their teaching process.

Therefore the school management has influence on enhancing the curriculum at hand by preparing the preliminary training of the teachers and enhancing the availability of the teaching and learning resources (Kimaryo, 2011). MOEVT (2007) suggests that in the light of the growing impact of advanced ICT on the economy of the

country, pupils should be provided with access to ICT-based tools so as to make a valid contribution to society. On the other hand ICT must be exploited to allow pupils to have greater control over their learning and thus develop skills at their own level and speed. Pupils on the other hand, need to be considered in terms of their understanding in ICT and the associated environmental problems especially with regard to their misconceptions about ICT in relation to environmental issues.

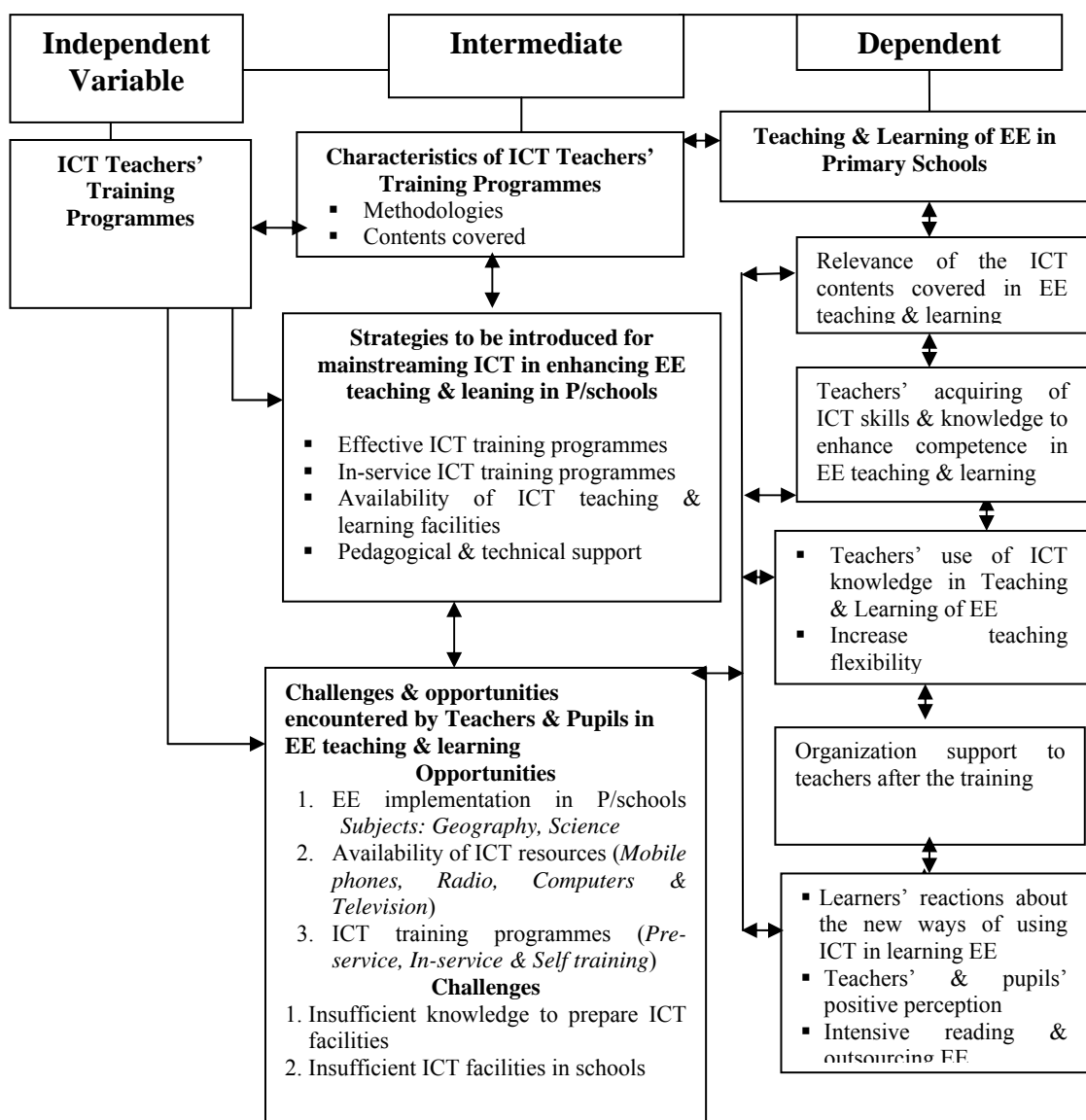


Figure 2.1: Guskey's Modified Five Critical Levels of Professional Development Evaluation

Source: Modified from Guskey, (2000).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodologies that were used in collecting data for this study. The chapter presents the research design, research paradigms, and characteristics of the study area, the target population, the sample, data collection methods and analysis techniques to be used in the study. Furthermore, the chapter discusses the reliability and validity of instruments for data collection, administration of instruments and ethical considerations.

3.2 Research Design

According to Yin (2009), research design is a plan outlining how information is to be gathered for an assessment or evaluation that includes identifying the sample and the instruments to be used or created, how the instruments will be administered, and how the information will be organized and analysed. A research design is a conceptual structure within which research is conducted (Kothari, 2004). This study employed the multiple case studies research design where various units within identifiable cases were studied as opposed to single case study where a case is being studied in its totality (holistic).

The multiple case studies were selected with the belief that the research questions could be best answered through the dimension which a multi-case study research design provides. However, the most important advantage presented by using multiple sources of evidence is the process of triangulation where more than one instrument of collecting data was involved (Yin, 2009). Before starting collecting

data in the field it is advised to prepare a case study protocol which should link between research objectives or questions and the data needed to answer those questions and the plan for collecting and analyzing data (Rose, 2015). In this study therefore, four objectives were considered to be the cases of the study in order to investigate the effectiveness of ICT training programmes in enhancing the teaching and learning of EE in primary schools.

3.3 Research Paradigms

In educational research, two paradigms exist namely interpretive/constructivist paradigm and positivism paradigm (Omari, 2011; Gatsha, 2010; Creswell, 2009). Interpretivists claim that reality exists within people and by asking people one can construct the reality of the phenomenon. The interpretivists seek to understand experience, behaviour and opinion of individuals in a natural setting hence a naturalistic inquiry (Patton, 2004). The interpretivists further consider understanding the issue in its natural setting with emphasis on a small sample but with thick data description. Contrary, positivists bank on developing theories, and scientific law based on statistical testing. This paradigm claims to use statistical methods to generate conclusion using wider sample as opposed to interpretivists (Omari, 2011; Gatsha, 2010; Creswell, 2009). For the purpose of this research, the researcher considered the interpretivists paradigm to lead the investigation. However, quantitative approach was employed in data analysis where frequencies, percentages, tables and graphs were used for statistical clarifications.

An integrated approach was selected because it is believed that a study that contains only qualitative data will miss the rich texture of interpretation that an integrated

approach makes possible. Also multi-research approaches complemented each other, enabling validation of data through triangulation of data from questionnaires, interviews and observations (Cresswell, 2009). On the other hand, multiple data collection methods enable crosschecking of information collected to ensure high levels of validity of findings. Qualitative research led the study because the researcher considered it as the type of research which uses natural settings to explore the people's experiences and report by narrating the process of the phenomenon (Creswell, 2009; Denzin and Lincoln, 2005).

3.4 The Study Area

The study was conducted in Mara region where the selected primary schools in Musoma district were involved for the purpose of gathering various information with regard to research data. Mara Region lies between latitude 1°45' and 2°45' South of the Equator and between longitude 33°15' and 30°39' East of Greenwich Meridian (Musoma Municipal Offices, 2015). The region is bordered by Lake Victoria to the West, Simiyu Region to the South, Arusha to the East and Kenya country to the North. Except for Tarime district which receives rainfall almost throughout the year, the rainfall in the region is bimodal with variations according to ecological zones. The main rains are between March and June and short rains between October and December. The head quarter of the region is in Musoma town. Musoma district was purposively selected because in the district there are numerous teachers who have previously participated in ICT teachers' training programmes.

3.4.1 Criteria for Selecting Mara Region

To select the area of the study, purposive sampling was used because Mara region

like other regions found along Lake Victoria have been seriously affected by various environmental issues such as deforestation, unsustainable resource use practices, illegal fishing and bushfires but mostly affected by the poor management of mineral wastes in areas with mining sites (WWF, 2014). It was felt that teachers and pupils in this region would more likely be faced with problems associated with degraded environments and would have experienced efforts being made to redress the problems, and probably appreciative of rehabilitation programmes.

The sampled schools were randomly selected from 16 wards that are found in Musoma municipality. The intention was to cover at least half (50%) of all the wards in Musoma municipality. Therefore, nine schools were from Makoko ward (School A), Mwisenge ward (School B), Kamunyonge ward (School C), Mukendo ward (School D), Iringo ward (School E), Nyasho ward (School F), Kigera ward (School G), Nyamatare ward (School H) and Kitaji ward (School I). The schools were randomly but carefully selected from different wards in order to avoid choosing schools that were geographically close to each other. The simple random selection method was used to select the schools.

The names of all the schools in each ward were written on pieces of papers, and were put in 09 different boxes. After mixing them thoroughly, one school was picked from each box. This procedure assured that each school in the wards had an equal chance of being chosen in the study (Trochim and Donnelly, 2006). The schools were chosen from different localities because it was assumed that the location of the school would influence the teachers' teaching practices of EE. Although the schools were in different localities, they were similar in some aspects like class size, availability of

teaching and learning resources, and they followed a centralized curriculum.

3.5 Target Population

The target population means all members or individuals or groups or other elements that the researcher hopes to represent in the study (Flick, 2007). The target population for this study included primary school teachers and pupils in selected primary schools in Musoma district.

3.6 Research Sample and Sampling Techniques

3.6.1 Research Sample

A sample is a small group of respondents drawn from a population in which a researcher is interested in gaining information and drawing conclusions (Munn, 1996). The participants for the study came from 09 primary schools selected in Musoma district. Both of the sampled primary schools were government owned in order to obtain uniform information about how the ICT policy is implemented by the government in its owned primary schools. The selected schools followed the centralized curriculum. In order to obtain a sample size, purposive sampling techniques (Cohen, *et al.*, 2011) were utilized whereas 02 ordinary teachers teaching the subjects containing EE and head of school were selected in 09 sampled schools and 20 pupils were randomly selected in each school.

Heads of schools were purposively selected from the group of 3 teachers in each school in order to obtain the ICT training programmes opinions from the part of school administration. This made a total of 27 teachers' respondents and 180 pupils' respondents respectively. However, standard seven pupils were purposively selected

to administer the questionnaires. Standard seven were selected given their immense potential in EE experience as they began learning EE since the commencement of their primary school education hence expected to provide valuable information concerning the study. Twenty pupils in each of the purposively selected classes were randomly selected to avoid bias. However in order to obtain the broad coverage of EE teaching and learning experience, standard four to seven were used during classrooms' observations. The study on the other hand selected teachers who were teaching subjects containing EE as well as ICT subject teachers. The selected teachers were considered to be aware of EE as well as ICT issues in schools.

Prior to the actual administration of instruments of data collection, the pilot study was conducted in one school of Musoma district to ascertain the reliability of the instruments. There-after, the introductory ICT school based orientations to sampled teachers who were teaching the subjects containing EE were conducted. The orientation was conducted for four weeks where as two to three days were used in each sampled school. The number of days for orientation depended on the availability of ICT facilities at the school and the prior ICT knowledge on the part of sampled teachers. The orientation was about the basics of ICT such as the meaning of ICT, the ICT instruments that can be employed to enhance teaching and learning, the advantages of using ICT instruments to mention a few.

After the orientations, the sampled teachers were then allowed to conduct the actual classroom teaching and learning using the ICT facilities available at their context. After the actual classroom teaching, the researcher interviewed the teachers. After the interview then the sampled teachers were requested to fill the questionnaires of

the study. The other research assistants assisted to conduct the questionnaires to the pupils under the close supervision of the researcher.

3.6.2 Sample Size

The study sample comprised of 207 respondents from the following categories:

Teachers N = 27, Pupils N = 180. Table 3.1 summarizes the study sample.

Table 3.1: Respondents of the Study

Category	Projected Respondents	Actual Respondents	% of Projected Respondents
Teachers	27	27	100
Pupils	180	180	100
Total	207	207	

Source: Respondents' Questionnaires (2016)

3.6.3 Sampling Techniques

Whereas quantitative studies strive for random sampling, qualitative studies often use purposeful or criterion-based sampling (Patton, 2002). Some researchers suggest the size of the sample to be large enough to leave nothing new to learn. In other words, in conducting interviews, after the tenth one, if there are no new concepts or themes emerging, the themes or concepts begin to be redundant. Therefore it is suggested that if a researcher reach saturation prior to assessing ten people, he/she may use fewer sample (ibid). Assessing 20 to 30 people, is typically enough to reach saturation. There are no specific rules when determining an appropriate sample size in qualitative research studies. Creswell (2009) suggests only 20 to 30 respondents whereas Morse (2000) suggests at least six respondents. Qualitative sample size may best be determined by the time frame allotted in the study, resources available, and

study objectives (Patton, 2001). Therefore 27 teachers' respondents were selected in this study to cater for the qualitative data where 180 pupils were selected to obtain quantitative data of the study.

3.7 Data Collection Methods

The methods used to collect data in this study enabled a researcher to obtain both secondary and primary data.

3.7.1 Secondary Data

Documentary review was used to provide secondary data about ICT content and EE content in the PSC and its relationship with the local environment. The concept of document has been defined as any concrete or symbolic indication, preserved or recorded, for reconstructing or for proving a phenomenon, whether physical, mental or theoretical construct (Prior, 2003). Frohmann (2009) provides examples of documents suitable for documentary review in research to include government publications, newspapers, census publications, novels, film and video, personal photographs, diaries, visual and pictorial sources in paper, electronic, or other hard copy form. Documentary reviews were used to supplement the interview, observation and questionnaires' data (Cohen et al., 2011; Patton, 2002). The documents that were reviewed in this study include the syllabus of various primary schools' subjects in order to locate the EE content. The information were also obtained from text books, journals, internet information related to EE, magazines, published and unpublished dissertations and theses related to environmental issues to mention a few.

Prior (2003) mentions the advantages of using documentary review method for data collection in research to be; access to information that would be difficult to get in any other way, such as people or cases who might not be willing to talk in a formal interview or might be difficult to track down. By using documents you eliminate the effect that you, as an individual, have on a person or situation when you conduct research (the researchers' effect). Lund (2008) comments that most of the documents often make possible the collection of data that were collected over a longer period of time as well as using larger samples as compared to questionnaires or interviews. Also, using documents in research is economical, particularly when the documents are easily accessible and already located in your workplace, or on the internet.

The disadvantages of documents are that, documents are usually not designed with research in mind where as the information recorded may be incomplete or contain much more information than what you need. Some documents get misfiled, left on people's desks for long periods or simply just do not get fully completed at all (Cohen et al., 2011). In addition, the motivation to collect certain types of data will vary over time, perhaps related to the decision by a particular team to focus on a specific issue for a period of time or because of government targets (Riles, 2006). Document reviews were used to supplement the interview, observation and questionnaire data (Cohen et al., 2011; Patton, 2002).

3.7.2 Primary Data

Primary data were collected using in-depth interviews, questionnaires, and observation. The research employed multi-techniques in order to enhance accurate exploration, description and analysis of the study. This is because exclusive reliance

on one method may bias or distort the researcher's picturing of the particular slice of reality he/she is investigating (Cohen, 2007). Also the more the methods contrast with each other (triangulation), the greater the researcher's confidence. The data collection techniques are hereunder explained:

3.7.2.1 In-Depth Interviews

In-depth interviews are face to face interaction of a researcher with the interviewees by using highly flexible semi-structured questions. On the other hand, an interview is a conversation between two or more people where questions are asked by the interviewer to elicit facts or statements from the interviewee for the purpose of answering research questions (Best and Kahn, 2014; Cohen et al, 2011). The technique was useful because the researcher was able to control the proceedings and the direction of the discussion. The technique also offered the opportunity to get more information through free response type of communication.

Best and Kahn (2014) argue that an interview is often superior to other data gathering tools, because people are more willing to talk than to write; certain types of confidential information may be obtained that an individual might be reluctant to put into writing; the interviewer can explain and clarify more explicitly the purpose of investigation and the needed information; and the possibility to seek same information in several ways to check the truthfulness of the responses. Therefore, the researcher was able to obtain clarification, amplification, or detail and in that way ascertain what meaning the respondent had in mind. Descombe (1998) adds up that the interviews do not involve much technical paraphernalia, no complex equipment in order to collect information. Sometimes only a notepad and a portable tape

recorder are enough.

Apart from the strengths of the interview technique, the researcher was aware of the limitations of the technique. The interview has some challenges such as time consuming and the need of expertise to prepare interview questions in order to ensure content validity and reliability (Best and Kahn, 2014; Cohen et al., 2011). Other challenges include power relations that might result in bias, the possibility of taking the respondent out of context and lack of standardization in skills of the interviewer (Corbin and Strauss, 2008). In order to minimize some of these challenges, the researcher involved a prior consent of the interviewees, involvement of good planning of interview guides to assure validity and reliability, proper preparations and sensitivity to the complex nature of interaction during the interview itself to avoid the hidden dangers for unreliable information. Respondents of the interviews were the teachers teaching the subjects containing EE and the heads of schools. Interview guides used in this study are presented as Appendix 1.

3.7.2.2 Classroom Observation

Observation is a method that is used to collect real data in a natural setting (Cohen et al., 2011; Flick, 2007). Observation does not rely on what people say they do or what they say they think but rather draws on the direct evidence of the eye to witness events at first hand. According to Boyden and Ennew (1997), observation is the first method in the field research and should continue throughout fieldwork. Observation is the foundation of all scientific work, whether in the physical or social sciences. It is based on the premise that, for certain purposes, it is best to observe what actually happens. According to Cohen et al., (2011), observation can be structured or

unstructured. Structured observation needs to know in advance what is to be observed while unstructured observation is less clear on what it is looking for.

There is a direct and indirect observation. Direct observation involves studying participants while they are aware that they are being observed whereas indirect observation is about studying respondents while they are unaware (Corbin and Strauss, 2008). In this study, the researcher used direct observation. With the use of observation the researcher gains access to social interactions, physical activities, non-verbal cues, gestures, roles played by different actors in social settings and factors affecting the teaching and learning process (Cohen, *et al.*, 2011).

Observation as a method of data collection has advantages, some of them being the direct access to the social phenomena under consideration, collection of diverse forms of data from informal and unstructured approaches, can yield associated diverse types of data both qualitative and quantitative, it is flexible and applicable in many contexts, it provides a permanent record of events or behaviour, thus allowing further analysis or subsequent comparisons across time or locations under consideration; it can effectively complement other approaches and thus enhance the quality of evidence available to the researcher (Punch, 2009). Apart from advantages, observation has some limitations as a data collection method. Gibson and Brown (2009) point out some of the limitations to be: resource intensive and time consuming, susceptible to observed bias on the part of the observer that might undermine the reliability and validity of data gathered, it has the so-called observer effect, in which the presence of an observer in some way influences the behaviour of those being observed.

Being aware of the limitations, the researcher had some ways of avoiding or minimizing the limitations including triangulation method (Cohen, et al., 2011) and observation which was as unobtrusive as possible. Triangulation, be it data, investigator, theory or methodological triangulation, is a form of cross-checking information. Member checking is when the researcher asks for participant feedback on his or her recorded observations to ensure that the researcher is accurately depicting the participants' experiences and the accuracy of conclusions drawn from the data. Member-checking and triangulation were employed in the study as they are good methods to use when conducting participant observations, or any other form of qualitative research, because they increase data and research conclusion credibility and transferability (ibid).

The researcher was spending considerable amount of time in sampled schools hence the pupils got used to her. Also the pupils were used to the inspectors and other Teaching Practice (TP) assessors who were regularly visiting their schools to observe teaching and learning processes. In addition, during teaching practice of student teachers, assessors (teacher trainers) observed actual teaching in the classrooms. Through these regular classroom observations by the researcher and research assistants, trust, confidence and good rapport with teachers and pupils were developed and facilitated data collection with other instruments.

The researcher had advantage of familiarity of the area as most of the schools she was conducting a study at, she was also a teacher trainer when she assessed the university students and therefore she was accustomed to the observer's presence to both the teachers and pupils which minimised the observer's effect on the behaviour

of participants (Bryman, 2008). Through regular participant observations in the classrooms, a researcher may become an accepted member of the school community by which teachers and pupils may get used to him/her (Mnyanyi, 2014). During the observations, the researcher sat at the back of the classroom observing all teachers and pupils' actions that were taking place in the class by using the observation checklist and took notes in the researcher's notebook. Through the technique, the researcher was able to observe how primary school teachers are translating EE knowledge into the real classroom situation using ICT resources within their context.

3.7.2.3 Questionnaires

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering primary data from respondents. It is generally a series of written questions for which the respondents have to provide the answers (Bell, 1999). In this study questionnaires were administered to the teachers and pupils for the purpose of investigating their understanding of ICT and how they can be employed to make them aware of the environmental issues. Questionnaires have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data.

According to Gay and Airasian (2003), through questionnaires, large amounts of information can be collected from a large number of people in a short period of time and in a relatively cost effective way in terms of money, time and materials. Because of its anonymity, questionnaires encourage greater honesty. Questionnaires are also useful in that they can generate frequencies of responses amenable to statistical

treatment and analysis (Best and Kahn, 2014). In addition Cohen et al. (2011) mention the advantages of questionnaires as being clear on the needs to be covered in order to meet the purposes of research as well as to elicit the most appropriate kind of data to answer the research objectives. However, the disadvantages of questionnaires include the fact that, the response rate can be quite low and that the researcher is not able to predict if respondents have answered all the questions until after the collection of the instrument (Kombo and Tromp, 2006). Other limitations of using questionnaires are financial expenses, the possibility of loss of material on transit and sometimes respondents returning the questionnaires very late or not returning them at all.

Omari (2011) suggests that questionnaires require a careful and clear statement of the research problem being investigated otherwise ambiguity and misinterpretation will invalidate the findings. To respond to that challenge, a researcher carefully administered the closed-ended questions whereas the respondents were supposed to pick an answer from a given number of options (appendix 2 and 3). The advantage of closed questions is that the answers are easier to code and quicker to analyze. However, the disadvantage of closed questions is that they may not allow for every possibility, unlike open questions where the respondents have more freedom. To respond to that challenge, the researcher constructed the questions in such a way that a space was left at the end of each question to provide the freedom to the respondents in case of comments or additional points.

The questionnaires were administered in a pilot study that was conducted in one of the primary schools in Musoma district prior to using it for actual data collection in

the field. This increased reliability as the questions were properly structured after the pilot study. Also the experienced researchers were consulted to comment about the questionnaires whereas the comments were incorporated before the actual data collection in the field.

3.8. Data Analysis Techniques

The data that were obtained in this study were subjected to processing, analysis and presentation. Data were collected, coded and analysed to include frequencies of responses and percentages. The frequencies and percentages were also used for tabulation and graphics in order to enable easy interpretation and analysis. According to Adèr et al., (2008), the research should consider what data are relevant to collect and how to analyse the results from the collected data. In this study, qualitative data were obtained from interviews and observations and there after organized and subjected to content analysis.

On the other, hand quantitative data were obtained through questionnaires and there after subjected to IBM Statistical Package for the Social Sciences (SPSS version 20). SPSS is a software package used for statistical data analysis hence suitable for this study. Data were collected using Kiswahili and therefore the researcher translated the collected information from Kiswahili to English language followed by the allocation of codes based on research themes in order to assure anonymity of the respondents. Quantitative data were further presented using tables, graphs and in terms of case experiences, quotation marks were used. Data collected through observations were presented using various illustrations as obtained from lessons' presentations to support the data collected through the questionnaires and interviews.

3.9 Reliability of Instruments of Data Collection

According to Babbie (2010), reliability refers to the quality part of the instruments use that makes it possible to yield similar results every time the instrument is used in different measurements of the same phenomenon. Cohen (2007) defines reliability as the stability and consistency of the measurement used, which ensure that each time the measurement is used, it is capable of yielding the same results. In other words, reliability is the accuracy and precision of a measurement procedure which indicates the degree to which an instrument measures what it is supposed to measure (Kothari, 2004). Both external and internal reliability were considered in this study. Internal reliability is the extent to which data collection, analysis and interpretation are consistent given the same conditions whereas external reliability is the extent to which independent researchers can replicate studies in the same or similar conditions.

3.10 Validity of Instruments of Data Collection

On the other hand validity is defined as the trustworthiness and accuracy of instruments, data, and the findings in research (Babbie, 2010). Kothari (2004) refers to validity as the extent in which a test measures what it actually wishes to measure. In this study validity were considered as follows.

Firstly was by pilot testing of the instruments of data collection in one primary school (Azimio) located at Musoma district. The pilot study involved 03 teachers and 20 standard seven pupils. Pilot study was inevitable for identifying and rectifying shortcomings in the instruments, and addresses them before the actual data collection is undertaken (Babbie, 2010). During the pilot study, the researcher also

made an observation inside the two classrooms and outside the classrooms by using her observation guide. Gatsha (2010) holds that validation of instruments helps to improve the clarity of questions. Therefore the pilot study assisted to improve question items by removing the terms that were considered ambiguous by the respondents in order to obtain appropriate answers of the study.

In addition the pilot study assisted to improve the clarity of the items in the instruments of data collection. This assisted the increase of the collected data accuracy in order to guarantee the reliability and validity of results (Cohen, 2007). After the pilot study, the questionnaires, interview guides and observation guides, were further developed and revised by the researcher after reading the related literatures and by seeking advice from the qualified personnel and further guidance from the supervisors. The pilot study, contained relevant comments and ideas from respondents that assisted the researcher to modify the coverage, content and predictive validity of the instruments. Thereafter, the instruments were administered in the actual study according to the selected sample.

Secondly, to ensure the validity and reliability of findings, multiple methods were used in data collection, analysis, and presentation of the study findings. The use of multiple methods was useful in enriching each other, thereby supplementing the drawbacks of one another. The use of multiple research methods was also important for triangulation. Teachers and pupils were involved in the study through questionnaires, in-depth interviews and observations. Internal validity demonstrates that the findings from the study will describe or explain accurately the phenomena (relevance), while external validity is the degree to which results can be generalized

to the wider populations, cases or situations (ibid). In this case therefore, the researcher expects that the above instruments can be used elsewhere in a similar study.

3.11 Ethical Considerations

Kimmel (1995) defines the term ethics as a person's character or disposition. The issue of ethics has to be considered especially when the research involves people. Cohen (2001) suggests that ethical issues must be considered because they protect both the researcher and the participants of the research from potential harm or conflict that may be caused as a result of the research. Kvale (1996) points out that there are three ethical considerations which have to be taken into consideration in conducting research. These include the informed consent of the participants to participate in the study, confidentiality and consequences. Also acknowledgement of all the people who have participated in the research for their contribution and support (Cohen, 2007) has to be made.

The researcher was aware of that and therefore the ethical considerations was adhered to, by involving the informed consent of the respondents to participate in the study, individuals' freedom to decline from participation, the assurance of maximum confidentiality and protection from physical and mental discomfort, assurance of anonymity, and on what should be disclosed out of the collected data. The researcher clarified to the respondents that the collected data was for academic purpose only. The names of the respondents and schools were not necessary in this study which ensured the respondents that their personalities were not anyhow exploited. Other procedures such as request of permission to collect data as required by the Open

University of Tanzania (OUT) where a researcher was working were also taken into consideration. Also permission was sought at Mara regional authority and thereafter at Musoma district authority to collect data in the sampled schools.

CHAPTER FOUR

FINDINGS OF THE STUDY

4.1 Introduction

This chapter presents findings of the study. The chapter is organized into the following sub sections based on the specific objectives of the study: opportunities and challenges for integrating ICT in the teaching and learning of EE in primary schools, characteristics of ICT teachers' training programmes, how the ICT teachers' training programmes were effective in enhancing teachers' professional competence in teaching of EE as well as strategies for mainstreaming ICT in enhancing EE teaching in schools. The chapter begins with the summary of the characteristics of the teachers' respondents used in this study (Table 4.1).

Table 4.1: Characteristics of the Respondents

Characteristics	Profile	Frequency	Percent
Gender	Male	14	51.9
	Female	13	48.1
Computer Literacy Level	Advanced	3	11.1
	Average	15	55.6
	Low	9	33.3
Teaching Experience	0-10 Years	16	59.3
	11-20 Years	09	33.3
	21-30 Years	01	03.7
	Above 30 Years	01	03.7

Source: Teachers' Questionnaires' Responses (2016)

4.2 Challenges and Opportunities Encountered by Teachers and Pupils in the Current ways of Teaching and Learning EE

This section presents the findings of the first research objective focused on investigating the challenges and opportunities encountered by teachers and pupils in the current ways of teaching and learning EE.

4.2.1 EE Implementation in Primary Schools

The researcher began by providing the orientation to the teachers about the meaning of ICT and the envisaged available ICT facilities at schools. During the orientation, the researcher sought the teachers' understanding about the terms at hand by interviewing the sampled teachers. The major terms that the researcher was interested to find their meanings were ICT and EE as the key terms used in this study. Twenty two teachers (79%) out of 27 teachers responded that ICT is the use of computers for teaching. Only 05 teachers (21%) responded that it is the use of ICT facilities such as computers, television programmes, radio programmes and the like for teaching and learning process. This implied that, to majority of teachers the availability of ICT at their schools meant the availability of computers at their schools.

On the other hand, 24 teachers (89%) expressed the meaning of EE as the education that deals with the management of the environment. The clear responses about the teachers' understanding of the term environment indicated that EE is adequately covered in primary school curriculum. Through interview, teachers indicated that the subjects that contain EE include Geography, History, Civics, Science, Personality Development and Sports, Mathematics, Kiswahili and Vocational Skills (Table 4.2). Documentary review was also used to get the findings of EE topics in the primary school curriculum.

From Table 4.2 it is indicated that EE is adequately integrated in primary schools hence well implemented. However teachers indicated that EE is currently not a subject on its own but integrated in other subjects. They further indicated that EE

could be identified more clearly in some subjects such as Science, Social Studies (History, Geography and Civics) as compared to other subjects such as Mathematics, Vocational Skills and Languages.

Table 4.2: EE Topics Integrated into the Primary School Curriculum

Subject	Environmental Education Topic
Geography	Cleanliness at Home, School and the Neighbourhood, Conservation of the Environment, Economic Activities and the Environment, Natural Resources, The Interdependence of Things in the Environment, Ecosystem and Ecology, Environmental Degradation, Development Issues, Overpopulation, Weather, Water and Waste Disposal.
History	The Family, Culture
Civics	Citizenship, Defense and Security at School
Science	Health issues, Food and Hygiene, Health and Sanitation, First Aid, Living Things, Energy, Diseases, Water, Air, Matter.
Personality Development and Sports	Challenges and Risk Behavior, Health Issues, Personal Hygiene, Care of Resources and Life Skills.
Mathematics	Using the Environment to get Teaching Materials like Counting, Using the Environment as a Teaching Context like Identifying Different Shapes, Measurement, Drawing and Setting Mathematic Problems Related to the Environment.
Kiswahili	Self-Employment (Kujiajiri), Agriculture (Kilimo), Education (Elimu) and Nguvumali
English	Reading for Comprehension, Vocabulary and Composition Writing
ICT	Using Information Technology to Access Environmental Knowledge in Different Disciplines.
Vocational Skills	Handcrafts like Making Baskets, Pottery, Laundry, Cookery, Agriculture, Livestock Keeping, Poultry Keeping and Fishing

Source: Primary School Curriculum (MOEVT, 2014)

4.2.2 Teachers' Challenges and Opportunities to ICT Facilities in Primary Schools

In the context of this study, ICT facilities are regarded as the facilities that through technology can facilitate effective teaching and learning of EE. The available ICT

facilities' opportunities that were expected to be found at primary schools included computers, radio, television, videos, telephones and digital newspapers. The radio programmes were also expected to be broadcasted through programmes facilitated by TBC *Taifa* and other radio stations or recorded to other radio devices such as audio tape, online computer sources such as Google and electronic mail.

Teachers were therefore expected to facilitate the teaching of EE using the ICT facilities that were found within their context. Also teachers were expected to facilitate the teaching of EE through broadcast television programmes and television devices via recorded media for example DVD players, CD, VHS tape, floppy disk, DVD, VHS deck, flash disk and other external computer devices as well as the use of telephones to download EE teaching materials. The ICT facilities are in line with those identified by MOEVT (2007) to include all forms of technology that are used for communication and to transmit, store, create, share or exchange information. This broad definition of ICT includes technologies such as: radio, television, video, telephone (both fixed line and mobile), computer and network hardware and software; as well as the equipment and services associated with these technologies, such as electronic mail, text messaging and radio broadcasts.

Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology. The following are findings from teachers and pupils' responses about the opportunities and challenges that were seen to be encountered by the teachers in getting access to ICT facilities in the sampled schools.

4.2.2.1 ICT Training Programmes and ICT Expertise to Teachers

Teachers' interview responses revealed that twenty (74%) of the interviewed teachers, stated to feel uneasy to teach EE using ICT facilities among other reasons due to ineffective ICT training. In addition, nine teachers (33.3%) of the twenty seven interviewed teachers who appeared to attend the ICT training programmes coordinated by TEA in Musoma district commented that the programmes were useful to teachers. Eight (29.6%) teachers revealed that they attended their ICT training while they were being trained in TTCs (pre-service training). The ICT training programmes availed the rare opportunity among the teachers of Musoma district. However, all the teachers (100%) who attended the ICT trainings indicated that the trainings were not effectively covered especially on practical parts and pedagogical issues. This was a major challenge that the teachers faced with regard to the mentioned ICT trainings.

The teachers on the other side talked about the notion of expertise in terms of having mastery of ICT knowledge and skills to enhance the teaching of EE. They argued that in order for teachers to be able to use ICT facilities to teach EE they need to have ICT knowledge and also they have to be confident that they can teach it. The findings are similar to Gulbahar and Guven (2008) who made a survey on ICT Usage and the Perceptions of Social Studies Teachers in Turkey and found that the groups that sometimes and frequently use computer related tools in the classroom have a higher level of expertise than the groups that never use them. In other words, teachers who have a high level of expertise tend to use computer related tools in the classrooms more frequently than the others. As stated earlier, most of the teachers

claimed that they have received ICT training which however does not provide them the confidence to teach EE while integrating the ICT resources. The findings from the interviewed teachers further revealed that, the pre-service training from TTCs and the in-service training through TEA did not cover well the practical part of the training due to inadequate ICT resources to facilitate the training. As a result of this teachers feel that it is a challenge to teach EE through the use of ICT facilities.

Examples of the feelings shown by the teachers are presented in the utterance below:

Inadequate ICT knowledge and skills on the part of teachers is a big challenge towards the use of ICT facilities in teaching EE. It is true that not all the teachers who are now teaching EE in the schools got the opportunity of ICT training when being trained in teachers' training colleges. There are teachers who are in schools but have little idea of ICT. As a result, we feel challenged when we are told that we should use ICT facilities to teach various subjects including EE. (Respondent 4).

Another respondent had this to comment

The challenge which I face in teaching EE is that I do not have the expertise to use the ICT facilities to teach EE. I am not conversant with the skills of the practical part for example the setting up of the computers and the repair of the computers when I need to teach the pupils using ICT facilities. (Respondent 12).

Overall, teachers have indicated that, they face various challenges in the use of ICT facilities to teach EE. The major challenge expressed by teachers was lack of knowledge to prepare the ICT facilities before the teaching session. The challenge was also failure to repair the computers and other ICT facilities especially when they get damaged.

On the other side, the notion of expertise was measured through questionnaires. The researcher requested the teachers' respondents about their technological competence

after the training. Figure 4.1 summarizes the results by indicating that 15 sampled teachers (55.6%) lacked technological competence to put the materials into use whereas 6 teachers (22.2%) had little technological knowledge to enhance their use of ICT facilities. Therefore about 77.8% of the respondents indicated to have inadequate technological competence to put the ICT materials into use. The above results of the teachers' responses are also summarized by the graph below (Figure 4.1).

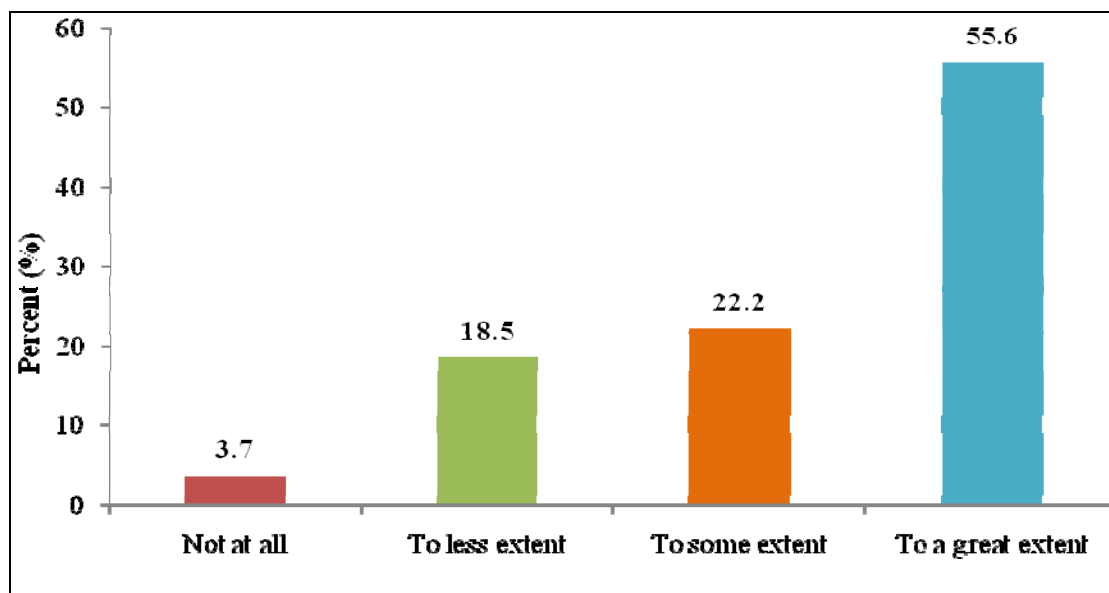


Figure 4.1: Technological Competence of the Teachers

4.2.2.2 Access to ICT Teaching and Learning Facilities

Access to ICT facilities was also expected to be one of the opportunities for the teachers to enhance their EE teaching and learning in schools. However, teachers mentioned inadequate ICT facilities as another challenge that was facing them in using ICT facilities in teaching and learning process. Twenty two (81%) out of twenty seven teachers who were interviewed stated that in teaching and learning, one of the critical challenges they face is lack of ICT teaching and learning facilities. The challenge was worsened by the overcrowded classrooms where the available few

ICT facilities were not able to cater for the bigger classrooms. The teachers accounted for this situation as a result of lack of proper funding in the primary schools. One head teacher had this to comment.

In primary schools first the classes are congested. In addition they don't have well equipped computer laboratories that assist pupils to learn ICT basic skills as well as assisting in proper teaching of EE. (Respondent 1).

Many teachers emphasized that lack of ICT teaching and learning facilities is the challenge that was facing them in the EE teaching process. The findings are in line with Nihuka and Peter (2014) who found that one of the challenges that the primary school teachers are facing in implementing the ICT curriculum is limited access to ICT facilities. Teachers in this case had no opportunity to access the teaching and learning facilities from different ICT sources and therefore depended on text books as a source of EE knowledge. However, EE knowledge can be obtained from different sources like television, newspapers, computer and its network hardware and software; as well as the equipment and services associated with these technologies, such as electronic mail, text messaging and radio broadcast. It all depends on the teachers' interest, awareness and initiative.

The findings from the interview revealed that even when the computers are available, teachers lack the technical knowledge to use the computers or repair them when they get damaged because they lack adequate ICT training. The findings are similar to Jones (2004) who reported that the breakdown of computers causes interruptions and if there is lack of technical assistance, it is likely that the regular repairs of the computers will not be carried out resulting in teachers not using computers in teaching. The effect is that teachers will be discouraged from using

computers because of fear of equipment failure since no one would give them technical support in case there is technical problem. Therefore lack of access to ICT teaching and learning facilities was seen as a major challenge to teachers that hinder the use of ICT facilities in EE teaching and learning process. Majority of the teachers including those who had the opportunity to attend the ICT training indicated that they were not getting the opportunity to access the ICT facilities to assist them in EE teaching and learning process.

4.2.2.3 Administration and Collegial Support

In this aspect, interviews as well as questionnaires were used to collect data. During the interview teachers indicated that there were limited support from the school administration and colleagues to assist the use of ICT facilities.

The following respondent had this to comment

Another challenge that we are facing is lack of support from the school administration. Sometimes a teacher may plan to use the computer laboratory with the internet connectivity to facilitate the teaching of EE to the pupils. But when he or she goes to ask for the support from the school administration the head teacher may discourage a teacher by the reason that they have not done the services to the computers due to lack of funds. (Respondent 3).

Overall, even the available few ICT competent teachers had little or no support to other teachers when it comes to the preparation or use of ICT facilities in teaching and learning process. The following respondent had this to comment:

One of the challenges I am facing in using ICT to teach EE is lack of support from other ICT experienced teachers. For example, if I want to prepare the computer laboratory to facilitate me in the teaching of EE, I go to ask other teachers for help, sometimes they say they do not have time or they tell me that they also do not have the technical knowledge to operate the computers. (Respondent 2).

Teachers expect to learn from each other and also they expect the school administration to support them in what they plan to do and teach. But from the questionnaires and interview' responses, it is revealed that there is lack of administration and collegial support among the teachers in the primary schools as far as the use of ICT facilities in teaching of EE is concerned. Similar findings were identified by Shadreck (2009) that although ICT opportunities are typically provided by the classroom teachers, the quality of leadership and management of ICT in a school is crucial to the provision of ICT learning opportunities. In this aspect, questionnaires were also used to summarize the teachers' responses (Figure 4.2).

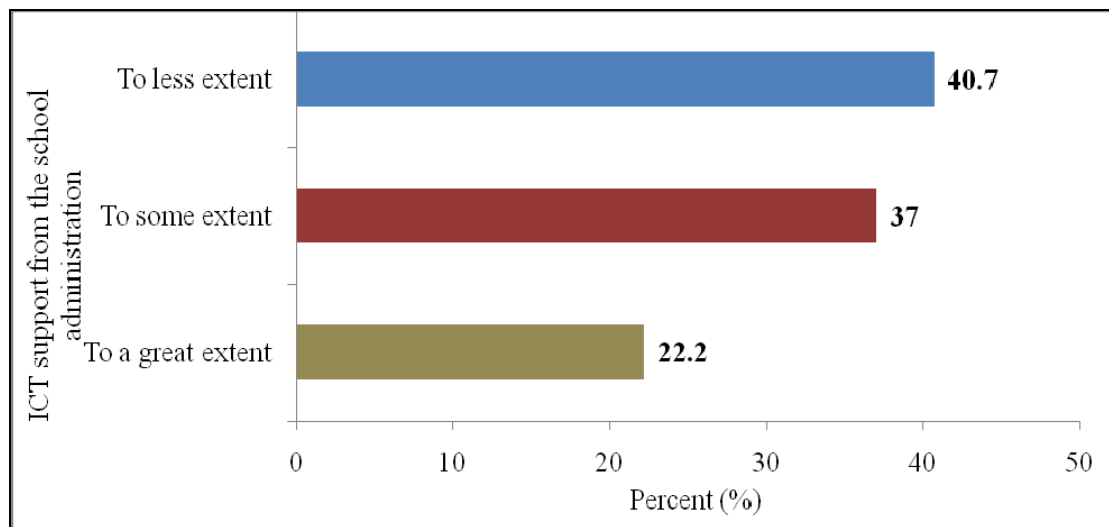


Figure 4.2: ICT Support from the School Administration

Figure 4.2, shows that 22% of the teachers' responses agreed that the school administration support towards the use of ICT in the teaching of EE was to the great extent where as 40% stated that it was only to less extent and 37% stated that it was to some extent. The findings from the questionnaires indicated that lack of administration support prevents teachers from using ICT facilities to teach EE effectively and even carrying out environmental management activities in the school

with the pupils.

4.2.2.4 Period Allocated Time versus Preparation of ICT Facilities

The findings from the interviewed teachers showed that the time allocated for a period is not sufficient as there is also time needed for preparations of ICT facilities before the commencement of EE subject. Majority of the interviewed teachers (25 teachers) indicated that most of the periods in the primary schools are allocated forty minutes. Also the syllabus specifies the number of periods for each topic. It is suggested that teaching EE with the use of ICT facilities should encourage active learning where the pupils learn by doing. But they wondered if forty minutes are enough to organize the pupils into carrying out different activities, then use ICT to link with what they have done with the EE subject content. Examples of the teachers' concern with time can be seen in the following statements:

The challenges I get include short periods because the duration of one period is forty minutes, so it is very short for me to involve pupils to actively participate in learning EE through the use of ICT facilities. (Respondent 3).

Another respondent had this to state

Another challenge is that the time allocated for a period is not enough. For example, how can you prepare the ICT facilities and also teach only in forty minutes? Sometimes we borrow periods from other teachers' subjects to make double periods, so that at least with eighty minutes you can try to do something but for forty minutes before you organize the pupils and assign them with tasks, the time is over and another teacher comes to teach another subject (Respondent 16).

The complaints of teachers on the time allocated for one period as seen from some of their statements is a challenge to the use of ICT facilities in the EE teaching process. Teachers stated that, the time allocated for most of the periods is forty minutes which is not enough to prepare and use ICT facilities given the constraint of technical

issues.

4.2.2.5 Class Size

In addition to the above mentioned challenges and opportunities, the findings indicated that, large class size was one of the constraining challenges in using the ICT facilities in EE teaching process. Few schools (3 out of the 9 sampled schools) were observed to have computer laboratories that were however not sufficient considering the number of pupils they had. Discussing large classes, the teachers in this sub-category talked about classes having many pupils, hence being a challenge to use ICT facilities in teaching and learning. The teachers complained that the classes were so big that they had up to eighty pupils in one class hence making it difficult to use ICT facilities such as computers to teach the pupils. Below are examples of the teachers' opinions on class size as an obstacle to the use of ICT to teach EE:

Another challenge is too many pupils in one classroom. First of all they are very curious which might cause the destruction of some of the computers' instruments. Secondly, it is difficult even to plan for the use of computer laboratory for EE learning because it is difficult to control more than eighty pupils in one class as their curiosity can cause the serious destruction of computer devices in the computer laboratory. In addition some of them may be busy with other odd things instead of concentrating with the EE lesson. (Respondent 25).

The above discussed challenges are summarized in the Table 4.3 hereunder.

Table 4.3: Challenges of Using ICT Facilities from Teachers' Responses

S/N	Challenges
1	Ineffective ICT Training Programmes and lack of ICT Expertise to teachers
2	Limited access to ICT teaching and learning facilities
3	Lack of administration and collegial support
4	Inadequate period allocated time versus preparation and use of ICT facilities
5	Large class size versus ICT facilities

Source: Teachers' Interview Responses (2016).

4.3 Characteristics of ICT Teachers' Training Programmes

In objective number two, the characteristics of ICT teachers' training programmes were considered to be methodologies used in the study that involve collaborative training, activities that are related to ICT content, sustainable training that was also expected to spread over long period of time with follow up trainings, follow up support and onsite support. It was envisaged that if the methodologies used were effective they could have enhanced effective teachers' professional competence of using ICT in teaching EE.

The ICT training also was supposed to have definite content in order to enable teachers adopt the content to assist them in teaching the pupils. The trainings on the other hand were expected to spread over long period of time with sustainable plans for the follow up trainings. In this part of the study, to ascertain if the characteristics of the ICT training programmes (pre-service and in-service) were effective in enabling classroom teaching and learning process, the researcher investigated the teachers' competence by observing them in the classroom situation. The observation was done after the ICT basic orientation that was provided to all the sampled teachers to orient them about what is ICT and the basic issues about ICT. Teachers' classroom practices in teaching EE using ICT facilities were observed in different subjects containing EE.

Prior to classroom observation, the researcher interviewed the teachers in order to know if the ICT trainings programmes covered the content it was supposed to cover using the appropriate methodology to cater for their classroom teaching and learning activities. Effective ICT training programmes were expected to enable teachers get

the basic knowledge and skills to assist them use the ICT resources found at their schools in EE teaching and learning process. When interviewed about the methodologies used and if they also covered the content they were supposed to cover, all the teachers commented that the methodologies used were not collaborative and the ICT training programmes were not sustainable.

On the other hand, the findings from the interview were supported by the administered questionnaires which indicated that to great extent teachers need more facilitation of knowledge in using ICT study materials for teaching and learning process (63%) where as other teachers responded that to some extent they need facilitation of knowledge (37%). There was no respondent in the category of “to a less extent” and to the category of “not at all” (Figure 4.3).

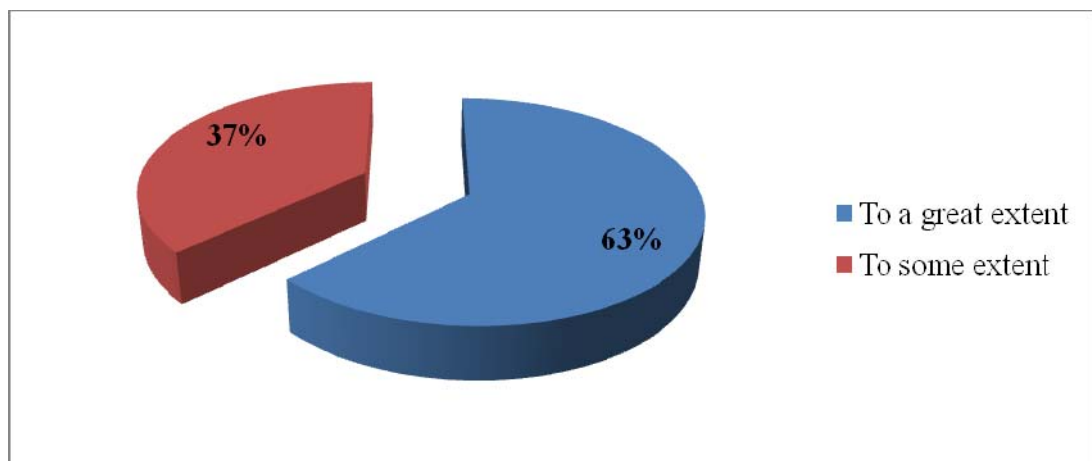


Figure 4.3: Teachers Need for ICT facilitation in integrating ICT in EE

Also during the interview teachers complained that the time allocated was short for the in-service ICT trainings to adequately cover what was supposed to cover. In addition teachers commented that there were no follow up trainings to make sure that the delivered knowledge are often updated to the teachers as the technology keeps on

changing. The findings are similar to that of Selwood (2007) who conducted a study in United Kingdom and found that although the primary school teachers appeared to be aware of the potential of ICT to reduce their workload and improve the quality of their work, teachers suggested that there is a need for more and better onsite training and time to practice what has been learnt in formal training sessions. In the same study, teachers also suggested that the ICT trainings should have adequate time and quality ICT resources.

4.3.1 Lesson Observations

The researcher had the opportunity to observe the teaching and learning process. In the following section, two out of nine observed lessons are described as examples of what may be considered as teaching EE while integrating ICT facilities. The researcher observed one lesson in each of the nine sampled schools two of them being described here under. The two described lessons were science for standard IV and geography for standard VI. The lessons were taught by the usual subject teachers who were quite knowledgeable and familiar with what they were teaching.

4.3.1.1 Observed Lesson Number 1

Subject: Science Standard IV (Respondent 11)

The lesson which the researcher observed in science was “Safety in the Living Environment” in standard four class. It was a forty minutes period. Pupils were learning on how to take care of the environment in order to avoid the risks that can be found in the environment. The teacher started by introducing the lesson through questions and answers. Because the lesson was participatory, the pupils had the opportunity to mention things like animals, insects, trees, and the like. Then the

teacher used the ICT facilities, in this case computers which were found in the school computer laboratory to showcase to the pupils on how to take care of the environment.

The teacher showed the pupils the cleanliness activities that are carried in the environment in order to avoid danger of insects, animals, snakes, flooding, to mention a few. It was observed that pupils were very active and interested in the lesson may be because they seldom use the ICT facilities in learning. However the computers that were connected with the internet were few as compared to the number of pupils. This consumed time because pupils had to use the few computers in turn.

4.3.1.2 Reflection of the Lesson

After the lesson, the observer and the teacher reflected on the lesson. The observer asked the teacher whether she had been successful in using ICT facilities to teach EE. In response to this, the teacher said:

Yes, I think I have managed, although in the ICT training they did not state how I should teach using the ICT facilities. However I have tried my level best. As you have seen, I used computers that are found at school to assist pupils outsource the environmental materials....(Respondent 14).

The pupils in the lesson were very active and interested in the lesson as teacher explained that in very rare cases they got the opportunity to use ICT facilities to learn EE. Also by using materials outsourced from the website, the teacher developed among the pupils the concept of recycling where the used materials such as plastic bottles can be recycled for other uses instead of polluting the environment.

4.3.1.3 Observed Lesson Number 2

Subject: Geography Standard VI (Respondent 15)

In the geography lesson for standard six class, the teacher was teaching the topic of “Economic Activities and their Effects on the Environment”. By using questions and answers, the teacher started by asking the pupils to mention the economic activities that are found in the environment and that can have effects on the environment. Pupils mentioned agriculture, livestock keeping, industrial activities, and mining activities, to mention a few. This was followed by outdoor activities where the pupils had the opportunity to visit one of the water sources that was seriously polluted by industrial and human activities. Upon their return to the classroom, the teacher instructed the pupils to form discussion groups to discuss how the environment can be polluted.

The teacher distributed in each small group some of the posters he had collected in due times and some extracts from online newspapers to assist the pupils in their group activities. After ten minutes of discussion, each group in turn mentioned one activity that makes water dirty. Some of the activities which they mentioned included washing clothes in the lake, bathing in the lake, sending animals to drink in the lake and dumping wastes in the lake. After the group work, the teacher gave the pupils the assignment to find out the dangers of making water dirty, which they would discuss and present in the next lesson.

4.3.1.4 Reflection on the Lesson

After the lesson, the observer and the teacher reflected on it. The observer started by asking the teacher if she was successful in using ICT in teaching the EE topic. The

teacher responded by saying that:

I think I was successful in integrating ICT facilities because I used the newspapers which I have been downloading from the internet in due course and other self-made posters to teach the pupils. Also I have tried my level best to use participatory method of teaching by encouraging pupils to work in groups which also encourage the collaborative learning. (Respondent 6).

The above two descriptions presented are just examples of how teachers use ICT facilities to facilitate the teaching and learning process in the primary school classrooms. The total of nine lessons was observed in nine sampled schools. The researcher was able to observe at least one teacher in each of the nine identified schools who tried their level best to use ICT facilities in the teaching and learning process. However, in most cases the ICT facilities such as computers were inadequate hence in some cases used as teaching aids rather than teaching facilities.

The major reasons the teachers provided for failing to properly integrate ICT in teaching and learning were: lack of effective ICT training that covered well the expected content using the appropriate methodology and unclear instructions to instruct them on where, when and how to use the ICT facilities. Teachers believe that the use of ICT to facilitate the teaching of EE assist pupils learn best and actively participate in the learning process. Teachers argue that when pupils participate in learning, they understand easily, and they get to know their environment well. The teachers' responses in questionnaires revealed that 59% of the respondents agreed that the use of ICT materials to a large extent increase options of ICT learning resources therefore increasing the learning flexibility (Figure 4.4).

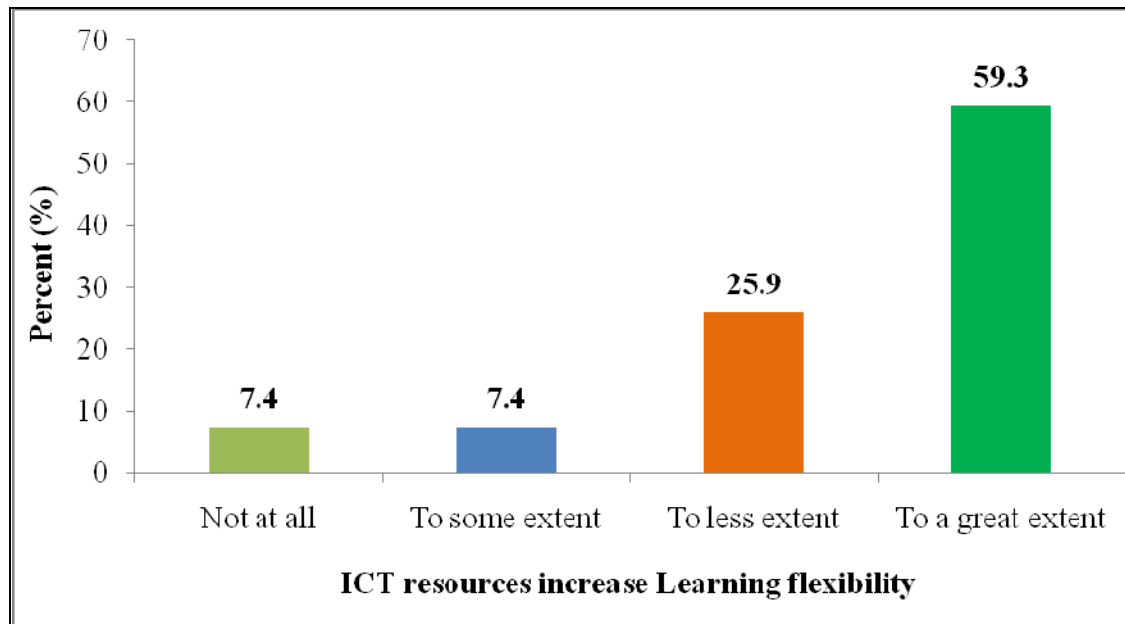


Figure 4.4: Learning Flexibility through ICT Materials and Learning Resources

In addition, teachers stated that by participating in the learning process, pupils would develop various skills which they can practice at home. Therefore, teachers were of the opinion that ICT should be thoroughly employed in teaching EE in all the Tanzanian primary schools. One of the teachers had this to comment:

The methods which are appropriate in the teaching of EE are those which give the individual pupil the opportunity to do things for him or herself. It is through learning by doing that the pupils develop different skills. For example, we insist that they plant trees so that they can get fruits, firewood, and timber for buildings. If we just tell them without instructing them to do it they will not be able to grow even a single tree when they go back to the community after finishing school.” (Respondent 12).

From the above quotes, overall teachers’ responses indicated that ICT enhance pupils’ participation in learning which stimulates thinking among the pupils. Teachers suggested that as the pupils are encouraged to use ICT facilities in learning, they develop thinking skills which assist them to become active in learning. The findings are similar to Fisher (2001) who found that in the participatory learning, the

thinking skills which the pupils are expected to develop include problem solving skills, critical thinking skills, creative thinking skills and formulation of concepts.

Another teacher whose subject was observed had this to comment:

I use group-work in teaching because in the groups pupils can share ICT facilities, ideas and work together either to solve a problem or make decision on a certain issue. This helps them develop the skills of working together, which are necessary for real life situations. (Respondent 22).

On the other side, the questionnaires that were administered to the pupils revealed that the characteristics of ICT teachers' training programmes were inadequate in enabling pupils to use ICT in learning EE. The pupils showed that the training of ICT to a large extent (35%) did not cover the content it was supposed to cover to enhance effective learning of EE. The large percent of pupils (39.4%) as compared to other categories in the question revealed that the teachers to some extent portrayed the competence deserved may be because of ineffective ICT training (Figure 4.5).

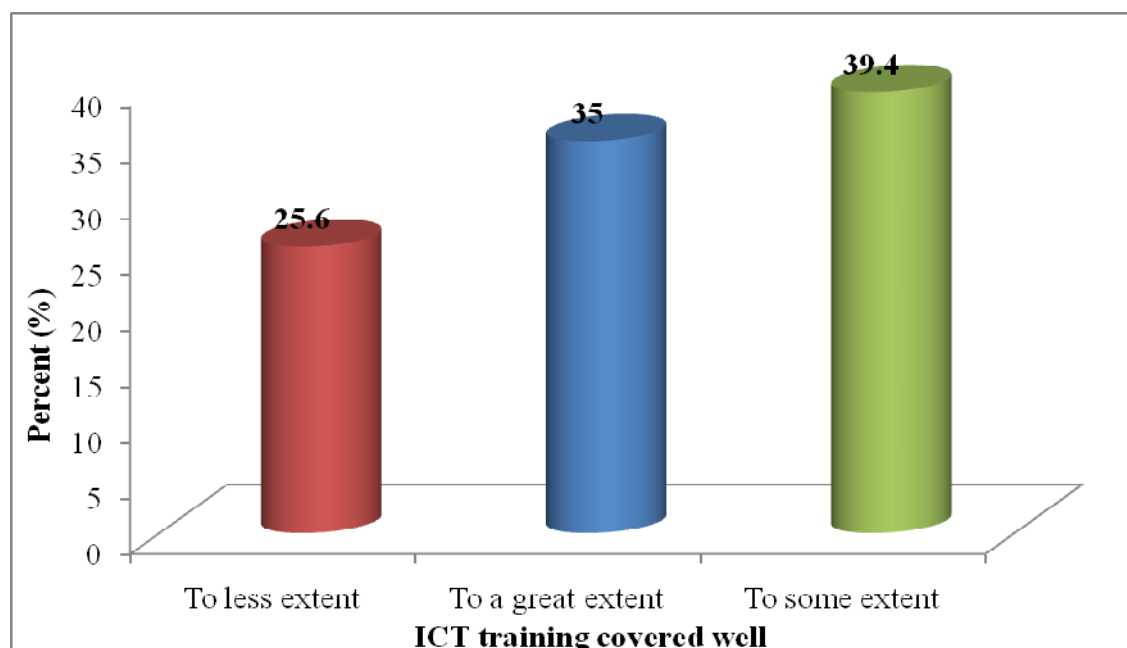


Figure 4.5: The ICT Training Versus Coverage of the Expected Content

Therefore, the findings above show that the ICT training programmes that were conducted were ineffective to enhance EE teaching and learning process. Effective coverage of the ICT training could have enhanced active learning of the pupils through the use of collaborative learning.

4.4 Effectiveness of ICT Teachers' Training Programmes

In this objective, it was envisaged that before the introduction of ICT teachers' training programmes, most of the primary school teachers were lacking knowledge and skills on ICT materials and on how to use them. The ICT training programmes were therefore expected to cater for the teachers' limited knowledge of using ICT facilities in the teaching and learning process. In the context of this study, the effectiveness of the ICT teachers' training programmes in enhancing teachers' professional competence in teaching and pupils' learning of EE involved aspects such as appropriate knowledge and skills and if they were sufficient to the primary school teachers after the training. Also the study aimed at finding out if after the training, the primary school teachers still rely on the traditional culture (are not using ICT facilities) in teaching and learning process. Interview, questionnaires and observation were used to collect data in this part.

In this section, the researcher presents the findings of the questionnaires of the teachers in the aspect of whether the ICT training covered the content it was supposed to cover. The teachers' responses revealed that the training of ICT did not cover well the content it was supposed to cover. The findings indicated that majority of the teachers' respondents (44.4%) stated that the ICT training programmes covered to some extent the content it was supposed to cover (Figure 4.6).

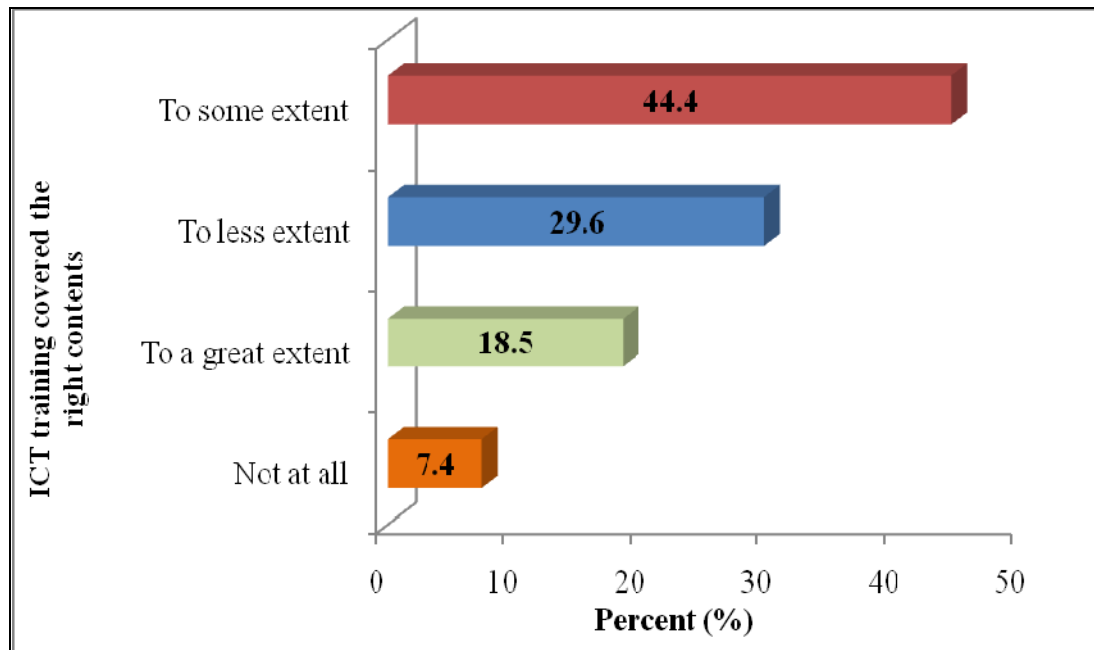


Figure 4.6: The ICT Training and the Content That Was Supposed to be Covered

In addition, the researcher interviewed the sampled teachers in order to get their views if various ICT training programmes conducted had availed to them effective ICT skills and knowledge to enhance their competence to teach EE properly. Majority of the teachers commented that the knowledge they got were not sufficient to enable their professional competence in teaching EE using ICT facilities. Teachers were in suggestion that if the ICT training programmes could have been effectively conducted, they could have assisted them to teach EE comfortably. The findings above were complemented by questionnaires provided to the teachers where 55.6% of the teachers stated that ICT training to a great extent enhanced the comfortable teaching and learning of EE where as 37% stated that the training assisted them to some extent (figure 4.7). Therefore teachers' respondents were of the opinions that if the ICT trainings were effectively conducted, teachers would have been enhanced to teach EE more comfortably.

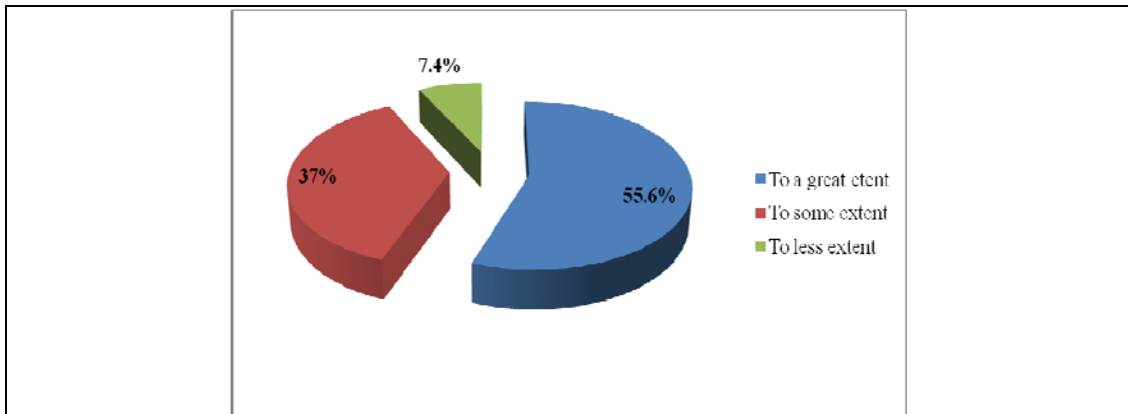


Figure 4.7: ICT Training Enable Teachers to Teach EE Comfortably

On the other hand the questionnaires administered to the pupils revealed that majority of pupils (Mean=3.3) to a great extent or to some extent perceived that ICT materials helped them to read intensively and outsource EE much easier (Table 4.4). Similarly, many (Mean=3.0) of the pupils to the great extent or some extent perceived that ICT materials increased teaching flexibility to teachers. This reveals that both teachers and pupils had positive perceptions on ICT integration in education since to teachers it tends to increase teaching flexibility while to pupils ICT facilities assist them to outsource the study materials.

Table 4.4: Pupils' Perceptions and Knowledge about ICT in Enhancing EE (n=180)

Statement	Cronbach's Alpha	Responses (%)				Mean
		Not at all	To less extent	To some extent	To a great extent	
I would like to use ICT materials but I don't have skills on computer applications	0.7	14.8	51.9	11.1	22.2	2.6
I like using ICT materials because it is very interesting which leads me to read much	0.7	7.4	22.2	25.9	44.4	3.3
Unreliable electricity makes the use of ICT materials unrealistic at times	0.7	14.8	11.1	33.3	40.7	2.7
I don't use ICT materials because I don't have a computer	0.7	25.9	11.1	37	25.9	2.6
I find using ICT materials increases learning flexibility by increasing options of learning resources	0.7	11.1	33.3	0	55.6	3.0
I can easily share ICT study materials with my fellow students as it is less expensive to use them	0.7	14.8	25.9	40.7	18.5	2.8

While there are a number of competencies that a teacher should have, this question had focused on the ICT pedagogical competence, knowledge and skills that the teachers have acquired after the ICT training programmes. Teachers with such qualities are considered to be competent for effective teaching of EE. Some of the teachers involved in this study indicated that they did not learn ICT when attending training at the teachers' colleges and they had not undergone any in-service training in ICT. Ten teachers (37.1%) out of twenty seven interviewed teachers said that because ICT is a current issue, they have been compelled to learn using their own initiatives by attending the private institution or learning through their colleagues.

Teachers who attended the pre-service training are the ones who have recently graduated from the teachers' colleges with one to five years' experience. The less experienced teachers also indicated that to them ICT as a subject is currently taught at the TTCs. Most of these teachers were the ones who were allocated to teach the ICT subject at the sampled schools. However teachers who got training while attending the teachers' training colleges were only 08 (29.6%) whereas 09 (33.3) teachers got their training through TEA in-service ICT training programme (Table 4.5).

Table 4.5: Types of ICT Training Programmes Attended by the Sampled Teachers

S/No	ICT Training Programmes	Frequency	Percent (%)
01	Pre-service Training Programmes	08	29.6
02	In-service Training Programmes	09	33.3
03	Self-training programmes	10	37.1
	Total	27	100

Source: Teachers' Interview Responses (2016).

Figure 4.8 hereunder indicates that 66.7% of the teachers have one to ten years of teaching experience. The findings of the interview above indicated that teachers with one to five years of teaching experience were seen to be more competent in ICT facilities in teaching and learning process compared to their counterparts.

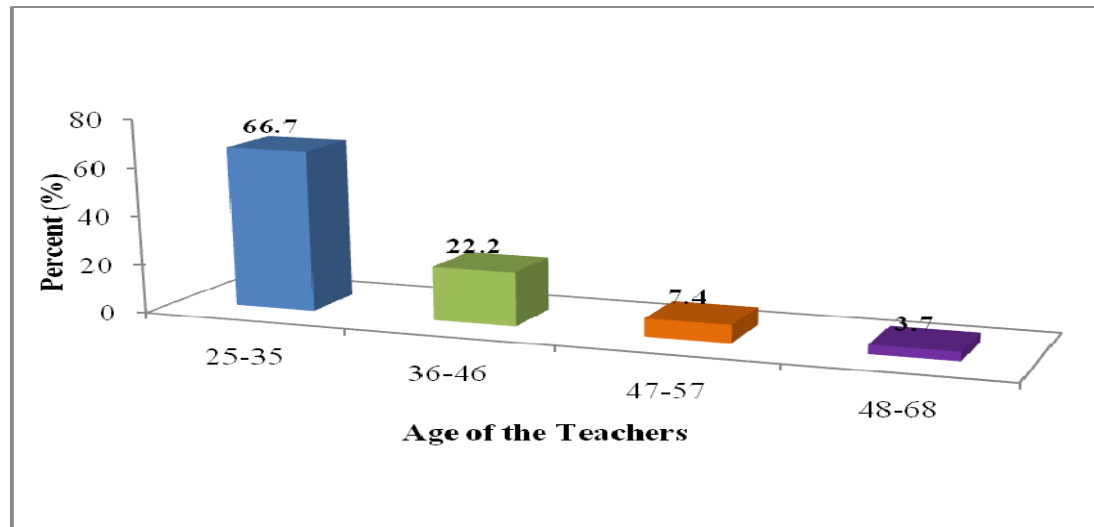


Figure 4.8: Teachers' Respondents' Age

Some of the teachers claimed to be competent because they had attended in-service training programmes in ICT. One of the ICT training programme that was mentioned by the teachers through interview was the training through TEA. In this programme, several schools were equipped with ICT teachers' training as well as computers to be kept at their schools (computer labs). The trainings were conducted in line with the major aim of MOEVT through ICT policy for basic education to ensure that ICT is adequately implemented in schools.

The government formulated the ICT policy for basic education in 2007 (URT, 2007). Three schools among the nine sampled schools were observed to have the computer labs that were enhanced through TEA training programme. Although the trainings were short-term (about three weeks), teachers admitted that they have to some extent

developed the abilities to integrate ICT in EE teaching and learning process. This can be supported by the following statements from the interviews:

I have the ICT knowledge and skills through the training I got from TEA. The knowledge and skills I got assist me in the teaching of EE. I am also able to use the ICT facilities such as computers, telephone and television programmes to outsource materials to assist me in teaching EE. (Respondent 27).

The in-service ICT training programmes enable the teachers to be more competent and also to be innovative as seen from the example given by the teacher above. However, majority of the teachers (48.1% to less extent, 22.2% to a great extent, 22.2%, to some extent, 7.4% not at all) complained that the methodologies that were used to facilitate the programme were not supporting the coverage of the content that was supposed to be covered. Table 4.6 below summarizes the results of the findings through questionnaires.

Table 4.6: Methodologies of the ICT Training Programmes

Category	Frequency	Percent	Cumulative Percent
	Not at all	2	7.4
	To less extent	13	48.1
	To some extent	6	22.2
	To a great extent	6	22.2
	Total	27	100.0

Source: Teachers' Questionnaires Responses (2016)

In addition the findings of the study in Table 4.7 reveal that about 58.3% of the primary school pupils who responded to the administered questionnaires, to some extent or to a great extent had limited knowledge to use ICT facilities in learning. Similarly, majority (71.8%) of the primary school pupils either to some extent or to a great extent agreed that most primary school teachers still rely on traditional ways of teaching.

Table 4.7: Pupils' Willingness to Integrate ICT in the Learning Process (n=180)

Statement	Responses (%)			
	Not at all	To less extent	To some extent	To a great extent
I have limited knowledge to use ICT in my learning process	24.4	30.6	25	20
Teachers with appropriate skills of technology use are insufficient at primary schools therefore difficult to facilitate ICT in the learning process	20	31.7	22.8	25.6
Most primary school teachers lack technological competence to put ICT materials in facilitating the EE learning process	16.1	28.9	34.4	20.6
Some of the primary school teachers still have traditional ways of teaching and learning styles	10	31.7	41.1	17.2
Primary schools lack appropriate software to prepare attractive ICT materials to be used in the learning process	18.9	29.4	25	26.7

Source: researcher, 2018

The findings reveal that both teachers and pupils had limited knowledge to use ICT facilities which perhaps influenced their willingness to integrate ICT in the teaching and learning process.

4.5 Strategies for Mainstreaming ICT in Enhancing EE Teaching in Schools

The fourth research objective concentrated on finding out the suggestions for the strategies to be introduced in order to mainstream ICT in enhancing EE teaching in schools. The objective intended to find out the suggestions provided by teachers for improving the ICT training programmes to enhance EE teaching and learning process in primary schools. The following are suggestions presented by the teachers as strategies to be introduced for mainstreaming ICT:

4.5.1 Effective ICT Training Programmes

During the interview, teachers suggested that more effective ICT training programmes need to be conducted to cement what they have gained in the previous ICT training programmes. The suggested ICT training programmes were expected to

merge both the practical and theoretical parts of the training rather than concentrating on theoretical part only. The major aim was to develop the teachers' ICT knowledge base in order to assist teachers integrate ICT facilities in teaching and learning process. During the interview, one teacher had this to comment

Given the importance of ICT in facilitating EE teaching and learning process, teachers should get the core training when they are being trained to become teachers. Therefore, teachers' education programmes should include ICT training in terms of well covered content as well as proper teaching methodologies, (Respondent 23).

4.5.2 In-service ICT Training Programmes and Follow up ICT Trainings

When they were interviewed, the vast majority of the teachers suggested that they would be happy if they could get further in-service ICT training programmes with regard to ICT in order to improve EE teaching and learning process. Teachers suggested that ICT training programmes should equip teachers with ICT material design as well as development of ICT materials. Teachers argued that it is important for them to get frequent ICT training because if they have to keep up with the changing technology, they need constant training to improve and update their ICT knowledge. This can be seen from the statements made by the teachers during the interview:

ICT training programmes should be frequently conducted to equip teachers with the fast advancement in technology so that they can know how they are expected to teach in the advancement of science and technology. After the initial training, the follow up trainings should be conducted often to assist teachers equip with the frequent change of technology. (Respondent 12).

Another respondent had this suggestion

The teaching of EE can be improved with the use of ICT facilities. This can be ensured when all teachers are undergoing the ICT training programmes regularly to facilitate them with the knowledge and skills to teach EE. (Respondent 21).

One head teacher even suggested that there should be a college where teachers can be trained in ICT either through the long-term or the short-term ICT courses.

There should be a college where teachers can be able to attend the ICT training courses. Every school can send at least three teachers to this college for ICT training and when they come back they can facilitate the training of other teachers in their schools. (Respondent 19).

4.5.3 Availability of ICT Teaching and Learning Resources

Within this category, teachers see that the way to improve the teaching of EE in the primary schools is to ensure that ICT teaching and learning resources are available. For example when interviewed, one of the teachers emphasized that MOEVT apart from training teachers, should also equip them with the ICT teaching and learning resources. With reference to teaching and learning materials, one teacher had this to comment:

The availability of ICT teaching and learning resources in terms of textbooks is crucial to teachers. Also the availability of ICT teaching guidelines are important in order to guide teachers while they are preparing the ICT facilitated EE lesson. (Respondent 20).

4.5.4 Availability of Adequate Computer Laboratories

The availability of ICT laboratories was another suggestion put forward by teachers. Teachers claimed that the unavailability of adequate computer laboratories causes the challenges in teaching EE using ICT facilities. In schools where there were computer laboratories, teachers admitted that the laboratories were very useful to them and they made the teaching of EE easier. Teachers suggested that instead of waiting for the government, the school can write proposals to request the donors to fund the schools to have their own ICT laboratories. Else through the school committee and parents involvement, teachers can involve the community to

contribute for the enhancement of ICT facilities at their clubs. The following respondents had this to comment:

ICT teaching and learning resources particularly computers, television, radio, newspapers to mention a few have to be available in schools to facilitate the teaching and learning of EE. Computer laboratories enhanced with connectivity are very important because they are the teachers' important sources of knowledge. (Respondent 11).

4.5.5 Pedagogical and Technical Support when Preparing ICT Facilities

Teachers requested the pedagogical and technical training to enhance them during the preparation of ICT materials for teaching and learning process. The findings from the questionnaires showed that 25 teachers (92.6%) were suggesting that more specific training is needed on technical part particularly on ICT material' design and development. The following figure (Figure 4.9) summarizes the results as captured from the teachers' responses

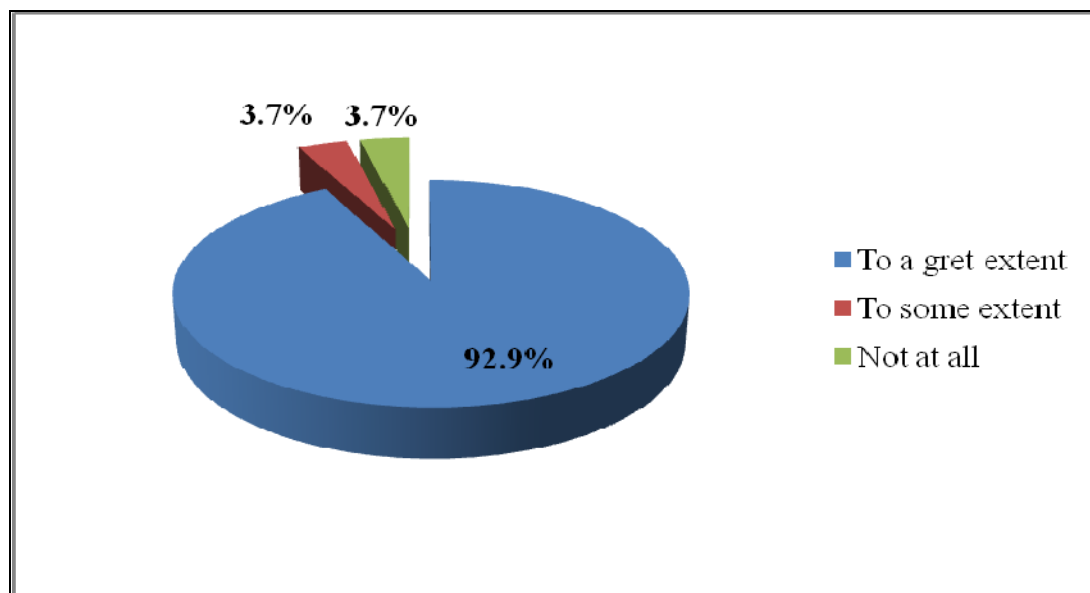


Figure 4.9: Training Needs on ICT Basic Technical Issues

Teachers therefore suggested that the training should dwell on technical part as well as material design and development. On the other hand, teachers suggested that the

school administration should ensure the availability of technical support through the ICT technical specialists.

Table 4.8: Pupils' Training needs for Effective Integration of ICT in Teaching and Learning (n=180)

Statement	Responses (%)			
	Not at all	To less extent	To some extent	To a great extent
I didn't undertake any training on ICT materials design and development	31.7	27.2	15.6	25.6
I don't have knowledge on using ICT study materials	13.9	37.8	32.2	16.1
I find using ICT materials time consuming	16.1	30.6	33.9	19.4
Sometimes computer may undergo mechanical faulty so there will be no access to the materials	13.9	27.2	28.9	30
I don't have technical knowledge to repair the computer when it is damaged	20	22.8	20.6	36.7

Source: researcher, 2018

In addition, Table 4.8 shows that about 58.9% of the pupils' respondents to a great extent or to some extent agreed once their computers undergo faulty were not able to access materials. In total, 57.3% of the pupils' respondents to a great extent or to some extent had no technical know how to repair their computers when damaged. On the other hand, 53.3% of the pupils to a great extent or to some extent found the use of ICT materials was time consuming. This implies that the majority of the pupils' respondents had inadequate skills and knowledge on computer repair and maintenance hence limited their learning process.

4.5.6. Provision of ICT Teaching Guidelines

Several teachers suggested that if ICT has to be enhanced effectively, then it would

be a good idea if ICT guidelines can be issued for the teachers to guide them while preparing the ICT facilitated lesson. They argued that ICT guidelines help teachers to know which lesson to teach using which type of ICT facilities and how to teach it. Also they suggested that guidelines would be very useful because they have not been properly trained to teach EE through the use of ICT facilities when preparing to be teachers. The following excerpts may serve as illustrations:

I suggest that, there is a necessity to have the teacher's guidelines on how to use ICT facilities in teaching EE. The guidelines will help teachers know what to teach and what ICT facilities to be used in which EE lesson. Also other ICT ordinary books should be available in plenty to enable teachers read on regular basis in order to get the thorough understanding of ICT. (Respondent 19).

From what the teachers suggested, it can be observed that the availability of teaching and learning materials particularly ICT textual materials is essential. The concerns expressed by the teachers during the interview show that they heavily rely on textbooks as the source of knowledge. This can be attributed to the way they have been trained and also the scarcity of other sources of knowledge in the schools.

The strategies are summarised in table 4.9 hereunder.

Table 4.9: Strategies of Mainstreaming ICT

S/No	Strategies
01	Effective ICT training programmes
02	In-service ICT Training Programmes and Follow up ICT Trainings
03	Availability of ICT Teaching and Learning Resources
04	Availability of adequate ICT laboratories
05	Pedagogical and technical support during preparation of ICT study materials
06	Provision of ICT teaching guidelines

Source: Teachers' Interview Responses (2016)

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the findings of the study that investigated the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in primary schools. The discussion is based on the findings of four objectives of the study, the reviewed literature and experience from the field.

5.2 Challenges and Opportunities of Integrating ICT in EE Teaching and Learning Process

The findings of objective number one show that there are few opportunities that facilitate the integration of ICT in EE teaching and learning process. The findings imply that the challenges facing teachers and pupils to integrate ICT in EE teaching and learning process were many and they outweighed the opportunities. Before identifying the challenges and opportunities of integrating ICT in teaching EE, the researcher saw the importance of finding out if the teachers had the understanding of the basic concepts of the study. The basic concepts in this study were considered to be ICT and EE. It was envisaged that if the teachers are to teach the ICT and EE concepts in schools, then they need to have a clear understanding of those key concepts. There is a relationship between the teachers' understanding of the content and pupils' learning.

Therefore according to the findings as captured through interview, the analysis of the teachers' perceptions of EE reveals that there are variations in the way teachers perceive EE. The perceptions given by the teachers emphasized the cognitive aspect.

In the first category their focus was on knowledge. They described EE as knowledge about the environment and also knowledge on how to take care of the environment. In the second category some teachers perceived EE as education that enabled individuals to develop problem-solving, adaptation and proper resource use skills.

The core idea in this category is the environment as something to be used sustainably by human being. This implied that teachers have a wider understanding of the term “environment” although they had narrow understanding of the term “ICT”. Teachers further attributed their narrow understanding of ICT to ineffective ICT training programmes that were conducted in order to assist them integrate ICT facilities in the teaching and learning process.

Also the findings of the study show that there are few available ICT opportunities in schools which imply that teachers encounter many challenges in integrating ICT in EE teaching and learning process. The few identified opportunities were found to be the availability of pre-service ICT training to some of the sampled teachers particularly those who have recently graduated from colleges. Also the findings revealed the training conducted by TEA to facilitate ICT in-service training programmes that availed the knowledge and skills to few teachers in the sampled schools.

In addition the findings of the study show the availability of computer laboratories in few schools as an opportunity to some teachers to use the ICT facilities in teaching and learning of EE. However, the study found out that despite the mentioned opportunities, the challenges outweigh the opportunities. The researcher was able to

group the challenges as indicated by teachers into three main categories, namely teacher related challenges, curriculum related challenges and teaching and learning related challenges. The challenges are summarized in the figure 5.1 hereunder.

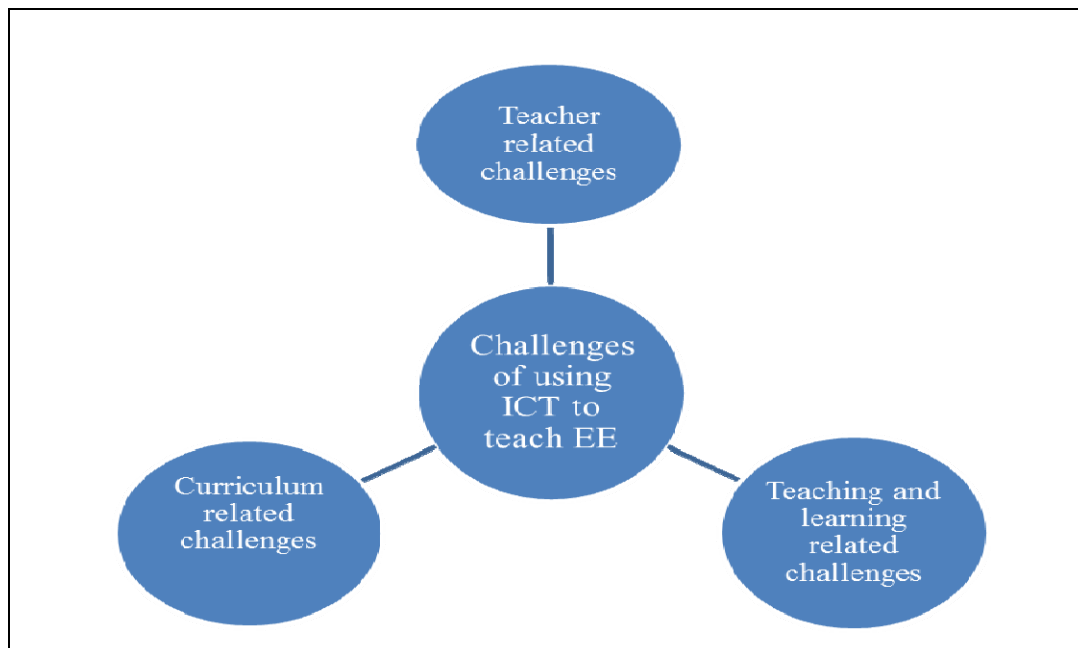


Figure 5.1: Challenges Facing teachers in Using ICT to teach EE

Source: Teachers' Interview Responses (2016)

5.2.1 Teacher Related Challenges

The findings revealed that teachers were not comfortable with the ICT training programmes that were conducted. This indicates that the ICT trainings that were conducted were not effective to facilitate the required skills and knowledge to the teachers. The findings further imply that integrating ICT in teaching and learning process would be possible if effective ICT training was provided to the teachers.

According to this study effective ICT training with the availability of ICT facilities may suffice effective teaching of EE using the ICT facilities. Teachers also require adequate time for preparations of ICT facilities and then use them in the teaching

process. Teachers being busy the whole day imply that it is also difficult for them to plan and then prepare the ICT facilities for teaching EE. The findings are similar to Abdelwahed (2016) who examines the current situation of ICT implementation at schools in Sudan and the barriers that prevent the implementation of ICT in schools and found that ICT implementation at the sampled schools was poorly achieved due to, among other barriers, inadequate technical support and lack of time to implement ICT in schools.

In addition, the findings implied that school administration support is mandatory to support the ICT training programmes that were conducted to the teachers in order to enhance the quality ICT learning opportunities. Though infrastructure support is imperative, school technology leadership is a stronger predictor of teachers to the use of computer technology in teaching. The findings are in line with Nihuka (2013) who found that for the effective integration of ICT in teaching and learning process, the school management needs to be receptive and supportive not only to the idea of application of e-learning but also supportive to instructors and learners in different ways.

The findings in this study revealed that even the few available ICT laboratories were not frequently used in teaching and learning process due to challenges such as lack of support to the teachers from the school management, lack of ICT skills due to ineffective training to the teachers to mention a few. In addition, even at the three schools where ICT laboratories were observed, the number of computers to enrich the teaching and learning processes was inadequate.

Moreover, in this study it was revealed that some of the teachers were using their personal initiatives to secure the ICT resources to teach their pupils. This was however done so using computers as teaching aids and not as devices to facilitate learning. In addition other teachers were using their personal computers to access EE materials in order to facilitate the teaching of EE. Needless to say, very few teachers got the opportunity to use their personal initiatives to facilitate the teaching and learning of EE using other ICT facilities such as television and radio programmes. These findings imply that ICT facilities were not adequately accessed at the sampled schools. The findings are similar to that of Banas (2010) who found out that only thirteen percent of the teachers were facilitating students' learning with technology whereas majority of teachers were getting learners to learn from technology.

Among the challenges which the teachers met in using ICT to teach EE are challenges that hinder the teachers' ability to teach EE competently by using ICT facilities. The findings imply that there is a necessity to enhance teachers towards teachers' professional competence in teaching EE using ICT facilities. Competence here refers to the teachers' ability to teach EE in terms of content and methodology that are required in using ICT facilities to expedite the smooth learning to the pupils. In analyzing the responses of the teachers, it was noted that the critical aspects in this category are lack of expertise to use ICT facilities hence a need for more effective ICT training.

The findings of the study imply that the ICT training programmes have not adequately assisted the teachers to teach EE effectively. The ICT training programmes have been identified to have been in two major categories including the

in-service training programmes and the pre-service training programmes. However some of the teachers were using their own initiatives to be trained in ICT private institutions. As mentioned earlier in chapter one, EE is crucial to be taught to the pupils using the modern teaching techniques. Similar challenges were identified by Stevenson (2007) who found that teaching barriers to the teachers are said to be based on the teachers' own practical theories of education which are believed to shape their pedagogical decision-making. These theories include what the teachers believe about schooling, knowledge, teaching, learners and learning. The application of EE knowledge assists in combating the environmental issues to the community therefore it is very important to take into consideration the support of teachers in using ICT modern facilities to teach EE.

The study found another challenge to be the use of ICT facilities in large classes. The findings imply that even the few available opportunities of ICT facilities in the computer laboratories were not effectively used due to large classes. Teachers were mostly concerned with the classes that had up to eighty pupils in one class hence making it difficult to teach pupils using ICT facilities such as computers. Teachers also had difficulties in classroom management especially to the congested upper classes.

5.2.2 Curriculum Related Challenges

The findings in this category implied that unclear instructions in the syllabus on how to use the ICT facilities hamper the integration of ICT in the teaching and learning process. The findings also indicated that there is insufficient time allocated for the periods in the school timetable. The other category of teachers suggested that due to

overcrowded syllabus, ICT can best be integrated into few subjects. This implied that the inclusion of ICT into the school curriculum should be done only in subjects whose content corresponds or matches with that of ICT because in some of the subjects the content does not match with the content of ICT. When the timetable is overloaded, teachers face the challenges of using ICT facilities in teaching EE. Teachers suggested that effective teaching of EE through the use of ICT facilities require adequate time for preparations of instrument and then teaching process. When teachers are busy the whole day, it is difficult to plan and then to prepare the ICT facilities to facilitate EE teaching and learning process.

Most of the teachers see unclear instructions as another critical challenge which inhibits them from effective use of ICT to teach EE in primary schools. Unclear instructions means the ICT trainings are not clearly stipulating what ICT facilities to use, how and where to use. In that case ICT training programmes have not effectively assisted teachers to have the clear knowledge about when and how to teach EE using ICT facilities.

The findings further imply that, effective adoption and integration of ICT infrastructure into teaching in schools depends mainly on the availability and accessibility of ICT resources both hardware and software. However in the sampled schools only three schools had the opportunity of having the computer laboratories with support from TEA. Other schools were observed to lack the ICT facilities that could have enabled them improve the EE teaching and learning process. Three schools among the sampled schools although found within Musoma municipality were found to be lacking the electrical power connection that made the utilisation of

ICT facilities in teaching and learning process even harder. The above findings are similar to that of Cavas (2009) who found that if teachers cannot access ICT resources such as computers, then they will not use them in teaching and learning process. On the other hand pupils were very interested to learn through ICT facilities as it increases learning flexibility although they showed their dissatisfaction with regard to various challenges that faced the schools towards using the ICT facilities.

All the above findings with regard to the curriculum related challenges imply that even after various ICT training programmes, the other teachers' concern was focused on the difficulty to teach EE using ICT facilities given the short allocated lesson time periods and unclear instructions about what and when to teach using ICT facilities. The unclear instructions made teachers to feel that although they are directed to teach various lessons including EE through the use of ICT, they get stuck when it comes to deciding which ICT facilities to use, when and how to use them. The use of ICT in teaching EE have to involve active learning. Therefore the school timetable with forty minutes per period does not suffice the teaching of EE using ICT facilities.

5.2.3 Teaching and Learning Related Challenges

The findings in this category were concerned with challenges related to the use of ICT facilities in teaching and learning of EE. The findings imply that, even if the teachers are equipped with the in-service ICT trainings to cement what the teachers have been taught during the pre-service ICT training programmes, effective teaching and learning takes place when a variety of teaching strategies and resources are provided in the classrooms. The findings are similar to Gulbahar and Guven (2008)

who found that teachers are facing challenges to use ICT facilities due to inaccessibility of ICT resources and lack of in-service training opportunities after the initial ICT training.

Analysis of the teachers' responses about the ICT opportunities available at schools revealed that ICT resources are insufficient at the sampled schools. Only three schools out of the nine sampled schools got the opportunity of having the computer laboratories. However, even in areas where there is availability of computer laboratories and other ICT facilities yet they are not effectively used in teaching and learning process. During the classroom observation teachers were seen to try their level best to teach using ICT facilities, although their efforts were hampered by lack of adequate ICT knowledge and skills.

The findings imply that the issue of pedagogical knowledge in any training is of great importance as it blends content and knowledge hence distinguishing teachers from other specialists (Tambya, 2008). Teachers claimed that they were not adequately enhanced with ICT knowledge and skills to facilitate the teaching of EE using ICT facilities. Only nine out of twenty seven interviewed teachers stated to have attended the TEA in-service ICT programme. The programme facilitated schools with the computer facilities as well as the training programme to the teachers for enhancing them to use the ICT facilities in teaching and learning process.

The issue of inadequate ICT expertise could have been minimized by the teachers learning from each other. Some teachers reported that although they are willing to teach EE using ICT facilities, they do not get assistance from the school

administration or their colleagues who have the ICT knowledge. In most cases teachers who were approached for assistance were not ready to help, claiming that they do not know or that they were busy.

Since ICT is considered to be a new subject, some teachers may genuinely not be knowledgeable so they cannot help their colleagues. However, other teachers were considered to lack confidence given that the ICT training programmes concentrated on theoretical parts rather than practical parts as it was revealed by the findings discussed above. The results support the view that teachers' limited knowledge base is a result of inadequate training particularly in their initial training as teachers (Spiropoulou, 2007).

In addition, some of the teachers in the study claimed that they do not get support from the school administration, particularly when the ICT facilities such as computer get faulty. The findings indicated that teachers failed to repair the damaged computers because they did not get basic skills on technical issues during the training. Basic skills could have provided the teachers with basic expertise to use and effect minor repair of the ICT facilities. The findings are similar to the study that was conducted in Turkey which indicated that while access to computers and internet were very high to the teachers in schools, some of the teachers indicated that they are not confident in using ICT facilities due to, among other reasons, lack of expertise to use the ICT facilities in teaching and learning process (Banas, 2010).

The claims of the teachers may be genuine, as they showed their dissatisfaction with regard to the funds allocated for the computer services at schools. Teachers indicated

that government primary schools are not allocated adequate funds to run most of the extra classroom activities rather than depending on pupils' contributions. The results from this study are similar to findings from the study done in the USA on middle school teachers where among the challenges which teachers face in teaching EE are lack of administrative support and funding (Ernst, 2009). The findings implied that, collegial and administration support are needed if teachers are to be assisted to grasp well the issue of teaching EE effectively using the ICT facilities. However, apart from being provided by the government, ICT teaching and learning materials can be developed by teachers from their own initiatives as few teachers were observed to be volunteering. The fact that pupils need resources and social structures to enable them to participate in communities of practice from an early stage in their learning process cannot be denied (Koskinen, 2010).

Therefore, lack of ICT teaching and learning facilities in schools is a critical issue which needs to be solved. Teachers need to be well trained to enable them use their initiatives to develop the ICT teaching and learning materials from the ICT facilities that are available in their surrounding environment. However, it was encouraging learning that few teachers were using their own laptops, televisions and radios to facilitate the EE teaching and learning process. The findings revealed that the issue of ICT teaching and learning materials is acute as teachers lack the knowledge, skills and commitment to look for or develop or search for their own ICT materials using their own initiatives.

The findings are consistent with the study conducted by Shadreck (2009), who pointed out that the successful integration of ICTs requires teachers who are

technologically competent, well trained and supported technically. However, the teaching of EE through the use of ICT facilities depends very much on the teachers' understanding of the ICT and their ability to use ICT in teaching of the subjects containing EE.

Nevertheless, the researcher identified few available opportunities which were the availability of TEA in-service ICT training programme, availability of computer laboratories in three schools as well as personal initiatives of few teachers to be trained and then utilize their own ICT facilities in teaching and learning process. In addition few teachers had the opportunity of being trained through the pre-service ICT training programmes recently introduced in TTCs.

5.3 Characteristics of ICT Training Programmes

The findings revealed that most of the characteristics that were considered to be crucial during the ICT training programmes were not adhered to. The findings implied that because the methodologies used in the programme did not involve collaborative training, various ICT training programmes that were conducted were not sustainable. The trainings such as the one conducted by TEA did not spread in a large area and also lacked follow up trainings, follow up support and onsite support. It was envisaged that if the methodology used were effective they could have enabled effective use of ICT in teaching and learning of EE. In addition, the findings showed that the content and activities in the training programmes did not cover what was expected by the teachers. This implied that the trainings were not effective in enabling teachers adopt the content that assist them in teaching the pupils.

However, the ICT training programmes as revealed from the findings were not sustainable and they did not spread over long period of time. In addition the training programmes were lacking the follow up trainings and onsite support to the extent that teachers failed to apply the knowledge and skills obtained from the trainings. The findings are similar to that of Guskey (2010) who found out that majority of teachers complain that most of the education trainings are not sustainable. The follow up trainings and onsite support could have provided the assistance wherever needed to enable teachers comfortably use the ICT facilities such as computers in teaching and learning. More importantly, when the teachers were sent back to the school, the administration did not support them in what they have been trained. Hence, after the training things break down at the school organization level.

The findings of the interview that was conducted prior the observation, revealed that teachers have undergone various ICT training programmes through pre-service training, in-service training and also through their own initiatives. Teachers who were less experienced in teaching were considered to be more active in using the ICT during the teaching and learning process. This implied that less experienced teachers attended their pre-service training in teachers' colleges during the time when the ICT training was already established at schools. Also, another in-service training was conducted by TEA with the aim of equipping teachers at work place with the ICT knowledge.

However, the findings revealed that the period of the training was too short and also the training concentrated much on theory rather than the practical training. The findings imply that majority of the teachers were left without the practical

knowledge and skills to operate various ICT machines such as computers when they want to use them during the teaching and learning process. The problem was worsened by the lack of onsite or ongoing ICT training support that could have enabled teachers to be furnished with the skills on how to operate the ICT machines such as computers.

In addition, the findings showed that teachers complained that what was taught was not enough to enable their competency of using ICT facilities in teaching and learning process. Also teachers complained that the methodologies used in the training did not enable them to comfortably teach EE using the appropriate methodologies. The findings revealed that methodologies used in both pre-service and in-service ICT training programmes were more of the theory rather than practical due to among other reasons lack of adequate ICT facilities to cater for the training needs. Hence teachers considered the characteristics of the programmes to be ineffective in enabling the teachers' use of ICT to enhance the teaching and learning of EE.

The findings of the classroom observation revealed that although teachers got the opportunity of attending the ICT training, what was taught in the classroom did not adequately reflect what they received. The findings imply that, the training characteristics that were expected from the ICT trainings conducted were not adequately covered. After classroom observation, a researcher was able to categorize teachers into three main groups. The first groups of the teachers were the ones who were observed to use teaching and learning resources other than ICT to facilitate teaching and learning process. Teachers in this category were the ones who received

ICT training through their own initiatives but due to ineffective training they received, it was a challenge for them to teach EE using the ICT facilities. In addition, teachers in this category complained to lack adequate knowledge and skills on how to integrate ICT in the teaching and learning of EE.

The findings showed that teachers in this category have never used the ICT facilities to facilitate the teaching and learning process. In this context, it was seen that proper facilitation of ICT training provides skills and knowledge to the teachers that assist them to use ICT facilities in teaching and learning. Teachers in this category were observed to use teaching and learning materials from the pupils' environment for example small stones, trees, plant leaves, flowers to mention a few or through various activities (outdoor learning) that are carried out in the environment. The findings also revealed that the other category of teachers who attended ICT training seldom used ICT in teaching and learning process claiming that the ICT training they attended did not cover the content it was supposed to cover because the methodology used were more theoretical rather than practical.

The categories of teachers who attended the ICT training struggled on their own efforts to organize the computer laboratory and teach the pupils through computers. These teachers seemed to be innovative because it requires a lot of skills on the part of teachers to link the subject content, EE content and the ICT teaching and learning resources given the nature of the ICT training they have attended. This could be seen from the example cited on lesson observation for science subject on the topic of safety in the living environment. The analysis of the teachers' teaching experiences also included the methods they used in teaching. Teachers' experiences in using

constructivist approach indicate that cooperation and interaction among the pupils is important because knowledge is gained in a communicative context.

To sum up, the ideas of the teachers in this category were seen to reveal the value of using participatory teaching methods in teaching through ICT facilities. However, through lesson observations, the findings revealed that some of the teachers were using less participatory methods preferably questions and answers. When asked why they preferred such methods they commented that the methods assist in the content coverage and in overcoming the challenge of large classes. The content focused lessons will ensure that pupils get the knowledge which will enable them pass the examinations. According to the teachers, the use of ICT is time consuming in terms of ICT facilities' preparation and therefore wasting time of lesson preparation, consequently, leading to failure to cover the content specified in the syllabus.

The study also found that ICT support in schools influence teachers to apply ICT in classrooms without wasting time for troubleshooting hardware and software problems. The findings are consistent with that of Mashwama, (2009) who identified that access to computers, updated software and hardware are key elements to successful adoption and integration of technology and therefore if teachers cannot properly access ICT resources, then they will not use them. Therefore access to ICT facilities is one of the effective ways to teachers' pedagogical use of ICT.

The findings of the study through teachers' observation further revealed that teachers had unclear instructions about the methodologies to be used while integrating the ICT facilities in teaching of EE. For example, teachers commented that if the

training could have covered well the practical part they could have acquired the basic technical skills to assist them to confidently prepare the ICT facilities.

From the findings of the study, the researcher was able to conclude that the first category of teachers who were using the ICT facilities, were competently using the participatory methods whereas the second category were considered to use the less participatory method. The use of the ICT facilities in teaching and learning process was considered by the teachers as the best method to use participatory approach. Participatory methods which are based on the constructivist view of learning have been found to enhance the capacity of thinking because pupils think with others (Mortari, 2003).

Various studies have recently found that majority of the teachers fail to implement the teaching and learning process through the use of ICT due to the challenge of missing effective and sufficient ICT training that could have assisted them with the knowledge and skills to use the ICT facilities. The ICT policy (MoEVT, 2007) suggests that the integration of ICT in teaching is important because during this era of science and technology environmental issues are expected to be taught using modern technology as well. Some teachers pointed out that they use participatory teaching methods during their teaching to enhance critical thinking to the pupils. Participatory methods also stimulate the development of more independent learning skills and higher order thinking skills (Vavrus, 2008).

While some teachers focused on the development of thinking skills, others focused on the social aspect of learning. They pointed out that participatory methods enhance

cooperation among the pupils. Participatory methods enhanced with ICT enable pupils take control of their own learning and cooperate with each other in the learning process. In emphasizing how participatory methods can enhance cooperation, student teachers in two teacher training colleges in Tanzania indicated that participatory teaching methods increase the quality of learning among learners and they help to develop mutual understanding between teachers and learners (Emsheimer and Mtana, 2004).

Therefore, to enhance cooperation, teachers in the study gave pupils the tasks which they did together as a group. In addition, when pupils do extra-curricular activities like cleaning the school grounds, cultivating in the school farm and watering the garden they cooperate with each other to accomplish different tasks. Different tasks carried out in schools to conserve the environment are in line with the main objectives of ESR. The ESR main objectives were to develop critical thinking skills, creativity, and self-confidence in pupils (Nyerere, 1967). According to the philosophy of ESR, education is expected to encourage pupils to have inquiring minds, as well as creative and cooperative attitudes. It was conceived that the education provided would help the individual solve his/her problems and those of the society in general (ibid). In short, the education provided in Tanzania is expected to address itself to the practical real life problem situations of the society.

On the other hand the findings of the study are in favour of supporting the realization of the Tanzania Development Vision 2015 in which among the five attributes of Tanzania in 2025 is to be a well-educated and learning society that would brace itself

to attain creativity, innovativeness and a high level of quality education in order to respond to development challenges and effectively compete regionally and internationally (URT, 1999).

The Tanzanian government recently has embarked upon the initiatives to improve the quality of education through the improvement of teaching and learning. The improvement has led to a shift from the formalistic teacher-centered teaching typical of Tanzanian schools towards the use of active, inquiry-based methods of teaching (Vavrus, 2008). Although efforts are being made by the developing countries to use ICT in teaching and learning, the modern methods of teaching are currently being applied more in developed countries rather than developing countries. In developing countries like Tanzania, there are still many challenges to enhance teachers' use of ICT facilities in teaching and learning process. In this study it has been revealed that lack of effective ICT training programmes that cover well both the content and methodology was mentioned as the major challenge that hampered the teaching of EE using the modern methodologies.

Other challenges that the study found out were inadequate ICT facilities as well as lack of support from the colleagues and the school administration. All the above challenges need to be taken into consideration when planning for the sustainable ICT training programmes so that teachers can utilize the modern teaching methods to confidently teach EE in primary schools. The teaching of EE is crucial when the country is striving to conserve the environment for the future generation and for the current welfare of the country.

5.4. Effectiveness of the ICT Teachers' Training Programmes

The findings of the study in objective three concentrated on the number of competencies that a teacher should have, including the ICT pedagogical competency (Mishra, et al., 2007) and knowledge and skills that the teachers have acquired after the ICT training programmes. Teachers with such qualities are considered to be competent in the effective teaching of EE.

In this part of the study it was found out that ICT teachers' training programmes were not effective in enhancing teachers' professional competence in teaching and learning of EE. The findings revealed that even after the ICT training, most of the primary school teachers are still lacking technological competence to put ICT materials into use. This implies that the aspects such as the appropriate knowledge and skills were not sufficiently covered during the ICT training programmes. The findings imply that the traditional method is still dominating during teaching and learning process particularly during the teaching of EE. These results are also in line with a survey made among science teachers in Hong Kong, where it was found that the most popular methods used to teach EE were traditional methods like lectures and experiments, and there was very little use of other modern methods of teaching EE (Chi-chung-Ko, 2003).

The study found that teachers who have recently graduated from the teachers' colleges are quite confident in terms of their ICT knowledge base as they have been studying ICT as one of the subjects recently introduced by MoEVT in all the Tanzanian teachers' colleges programmes. The introduction of ICT in TTCs is regarded as a way of improving teaching and learning in schools because teachers

would access and use ICT facilities to enhance their teaching (URT, 2007). Teachers in this category, although few, showed their willingness to teach EE through the use of ICT facilities because teaching using ICT facilities was not a problem to them.

The findings also showed that although most of the teachers did not receive the formal ICT training, all the sampled teachers were seen to have received the ICT training through different forms. The findings imply that teachers based their competence on the aspects of self-learning, pre-service training and in-service training, which will be discussed in the following sections.

5.4.1 Self-learning ICT Training Programmes

The findings indicated that the first category of teachers have the ICT knowledge from their personal learning. This category of teachers had basic ICT knowledge to teach EE in classrooms. These teachers feel that they have a responsibility to seek the ICT knowledge from different sources. Teachers in developed countries like Switzerland share the same thinking because they feel that they are responsible for filling their own knowledge gaps and it is a way to continue developing professionally (Lindemann-Matthies, 2009). The findings showed that some of the interviewed teachers were compelled to learn ICT using their own initiative because ICT is a current issue.

Therefore, teachers in this category attended the basic ICT training programmes that are provided by private colleges and or learnt ICT through their colleagues. This implies that some of the primary school teachers realize the importance of collegial support in developing their ICT knowledge base. The findings revealed that teachers

in this category are aware that learning is something that goes on and is not confined to a school or to a specific group of people. The critical idea in these teachers' statements is the teachers' role in the search for ICT knowledge to develop their own ICT knowledge base.

Searching for knowledge by teachers indicates their ability to expand their view of knowledge by going beyond the textbook. It is believed that schools with self-learning teachers develop attitudes of sensitivity, responsiveness and adaptability necessary to meet the external and internal changing conditions of the environment (Chi-Chung-Ko, 2003). Therefore, teachers should be encouraged to search continuously for knowledge from different sources instead of waiting for the government to organize courses and workshops for them. However, teachers in this category expressed their concern towards little technical knowledge to enable them prepare and use the ICT facilities in EE teaching and learning process.

5.4.2 Pre-service ICT Training Programmes

The study also found out that, after attending the pre-service ICT training programmes teachers felt competent in using ICT facilities to teach EE in the primary schools. This implies that teachers in this category were more competent in integrating ICT in EE teaching and learning process because to them the ICT lessons that are taught at primary school level are just the elementary lessons. The ICT knowledge for these teachers has been acquired from TTCs where they attended their teachers' training. Teachers in this group are the ones who have recently graduated from the teachers' colleges (1-5 years' teaching experience). This group of teachers was found to be more competent in using the ICT facilities as compared to

their counterparts. Teachers in this category, although few, showed their willingness to teach EE through the use of ICT facilities because teaching using ICT facilities was not a problem to them.

Most of these teachers were the ones who were allocated to teach the ICT subject at the sampled schools. They indicated that the knowledge they have is above the level that they teach. Also some of the teachers in this group have privately upgraded themselves to acquire more advanced skills on ICT. With such academic qualifications, they claim that the ICT content taught in the primary school is too elementary for them as compared to the ICT knowledge they have acquired. Teachers felt that they are confident and possess the required knowledge that assists them in teaching EE through the use of ICT facilities. What the teachers observed seem to be logical because the ICT knowledge required to teach at primary school is elementary. However, sometimes teachers are compelled to explain complex ICT terms in simple ways to fit the elementary level of pupils. The teachers in this category however suggested that the government should put more emphasis on the in-service ICT training programmes that will cater for the better pedagogical part of the training since technology keeps on changing.

5.4.3 In-service ICT Training Programmes

The study also found out that the other group of teachers was the one that had the opportunity to receive the training from the in-service ICT training programmes that are conducted at their work places. The findings revealed that teachers in the sampled schools received the training from TEA. This was an in-service training programme that aimed at equipping the primary school teachers with ICT knowledge

and skills as well as furnishing some of the primary schools in Musoma district with computer laboratories. This ICT training programme however, benefited only few teachers because of limited funds to facilitate teachers particularly on practical part. Teachers in this category demonstrated the importance of in-service training for teachers claiming that ICT training, if effectively conducted, widens their knowledge base and their professional skills, hence making them competent teachers.

However the findings of the study revealed that the competency of the teachers who received the training was on theoretical part only demonstrating the competency of subject matter only. The findings imply that although they received the ICT training, teachers are required to be competent on both theoretical and practical parts and to be conversant with both pedagogical knowledge and the knowledge of context. This was expected to assist teachers to have the ability to help pupils with what and how to learn using ICT while considering the pupils context as well. The categories of ICT training programmes are summarized in Figure 5.2.

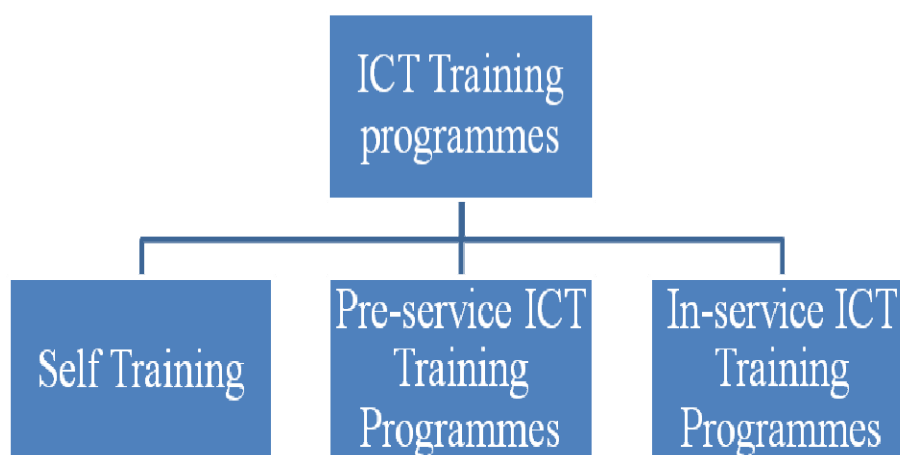


Figure 5.2: ICT Teachers' Training Programmes as Reflected by Respondents

Source: Teachers' Interview Responses (2016)

The study further found out that the competence of the teachers also depends on the availability of ICT facilities, services and funds at the school in order to facilitate teachers to use the ICT facilities in their teaching process. In this study therefore, it was found out that even after the training they got, teachers still found difficulties in getting support from the part of the school management in order to use the ICT facilities in the teaching and learning process.

The major factor is lack of funds to enhance the computer laboratories run effectively and to assist in furnishing the labs with services they require so that teachers particularly who have undergone the ICT training can get the opportunity to practice their knowledge and skills in the teaching and learning process. In addition, not many teachers get the opportunity to attend the in-service ICT training programmes or courses. The findings imply that there is a need to provide teachers with more effective in-service ICT training programmes in order to enhance their teaching and learning of EE.

While some of the teachers considered themselves competent in teaching EE through the use of ICT facilities, there were other teachers who felt that they were not competent. The teachers provided the following reasons, first they lack effective ICT training, secondly others attended the ICT training that was not effective to meet their goals and third because of the advancement in technology and frequent change of technology other teachers felt to lag behind in modern teaching techniques. As a result, teachers who were considered to be incompetent reflected the need for frequent ICT training programmes for teachers. They suggested that they need to be trained through workshops, seminars and short courses if they are to use ICT

facilities to teach EE effectively. The findings are similar to the study conducted by Banas (2010) which revealed that while computers and internet to the teachers in schools is accessible, some of the teachers indicated that they are not confident in using ICT in classroom teaching and learning activities. The survey also indicated low competence in web page development and multimedia authoring among pre-service teachers.

The basic idea characterizing the category of incompetent teachers is lack of training in ICT among teachers in primary schools. On the basis of what the teachers said, it is evident that teachers experience difficulties in using ICT to teach EE due to either ineffective ICT training or the absence of ICT training. However, the teachers indicated that the teaching of EE through ICT can be implemented effectively in primary schools if teachers receive effective ICT trainings in both pre-service and in-service programmes.

The findings also revealed that the technology has advanced drastically and it is constantly changing. As a result, what is known about the technology at a particular time may not be true after some time. The findings imply that teachers need to keep in pace with these changes. The teachers' voices indicated that teachers attribute their lack of competence in using modern technology to teach their pupils because of the recent advancement in technology. They suggested that they have to get frequent onsite ICT training in order to update their knowledge because technology is not static but dynamic. Teachers also need to have frequent learning wherever the technology changes.

In this subcategory, teachers focused on change and time in relation to place. By change, they meant the increase in scope or transformation of the way people see, understand, experience or perceive something in their environment. The change process is related to time because it happens over time. As a result of constant changes in technology teachers said that they always have to search for new knowledge if they are to teach effectively using ICT facilities. When teachers are not equipped with the required knowledge, they lose confidence and it becomes difficult for them to teach what they have not been trained to teach. Teachers need effective ICT training in order for them to teach efficiently. For the case of using ICT in teaching and learning process, teachers are required to master both the theoretical and practical part of ICT.

The limited available ICT training programmes however did not cater for both the theoretical and practical parts but rather concentrated more on theoretical training. In that case it was difficult for the primary school teachers to teach EE using the ICT facilities. This study revealed that few teachers were able to integrate properly the ICT facilities in EE teaching and learning process. The situation suggests that apart from the personal initiatives done by some teachers as revealed in this study, teachers should be given the opportunity to attend ICT in-service training programmes. Also teachers should be trained to use ICT facilities in teaching and learning process while they attend their training in teachers' colleges (pre-service training).

The findings of the study on the other hand revealed that most of the teachers even after the training did not have the ICT pedagogical content knowledge and skills to

enable them teach confidently. In addition, teachers who received the ICT training indicated that they were not competent in technological part. Teachers faced challenges especially when the computers and other ICT facilities undergo damage. Therefore teachers were of the opinion that the training should be conducted in such a way that teachers will also be competent in basic technical skills to assist them perform simple ICT facilities operations.

5.5. Suggestions for Strategies to be Used in ICT Training Programmes

In this part of the study, the researcher was interested to find out the strategies suggested by the teachers for mainstreaming ICT to enhance EE teaching in schools. The findings of the study revealed that teachers were willing to integrate ICT facilities in EE teaching and learning process if various strategies were introduced for mainstreaming ICT in enhancing EE teaching in schools. Teachers suggested that various issues need to be improved and or introduced in order to mainstream the teaching of EE using ICT facilities. Teachers suggested the introduction of effective ICT training programmes to equip them with both theoretical and practical knowledge. The major aim as suggested by teachers was to develop teachers' ICT knowledge base through in-service ICT training programmes. Teachers also suggested the ICT in-service training programmes to be well enhanced to concentrate on technical part as well. The reason behind is that even after the training teachers have been facing the problem of organizing the ICT resources and failure to perform minor repair of the ICT instruments when they get damaged.

On the other hand, teachers suggested that the ICT training programmes should particularly equip the teachers with ICT material design and development as well.

Teachers argued that it is important for teachers to get frequent ICT training because if they have to keep up with the changing technology, they need constant training to improve and update their ICT knowledge. The need for developing teachers can be considered as a means of empowering teachers, hence making them more competent in ICT to enable them teach EE effectively. In other words, teachers meant that there should be ongoing in-service ICT training programmes for teachers to help them develop their ICT knowledge and improve their day-to-day professional skills in teaching EE.

Also teachers suggested the need for availability of ICT teaching and learning resources in order to improve the teaching of EE in primary schools. With reference to teaching and learning materials, some of the teachers talked about the availability of ICT teaching and learning resources in terms of textbooks while others suggested to receive the ICT teaching guidelines to guide teachers while they are preparing the ICT facilitated EE lesson. In addition to ICT facilities teachers suggested the need for availability of adequate ICT laboratories. In schools where they had ICT laboratories, teachers admitted that they were very useful to them and it made the teaching of EE easier.

Teachers suggested that instead of waiting for the government the school can write a proposal to the donors to fund the schools to have their own ICT laboratories. Else through the school committee and parents involvement, teachers can involve the community to contribute for the enhancement of ICT facilities at their schools. Also teachers requested for the pedagogical support when preparing ICT study materials where apart from attending the ICT training, teachers suggested that the support for

the preparations of ICT materials in schools is required. Teachers requested for the availability of ICT technicians when the computers get damaged to assist them to repair the computers. The provision of ICT guidelines was also insisted by the teachers so that they can be able to know how and where to teach EE using the ICT facilities.

Therefore all the sampled teachers admitted that it was important to teach EE through the modern ICT facilities. The findings imply that the teaching of EE was important to be conducted through the modern technologies to equip the teachers with the most current updates with regard to environmental issues. Teachers indicated that ICT has made it easy for the teachers to update EE teaching-learning materials by reading and learning more about the latest materials which improves their work. ICT has also been observed to provide security to teachers and administrators' confidential information such as examination reports. Pupils also were seen to actively participate in the EE lessons taught through the assistance of ICT facilities rather than the lesson that was not prepared with ICT facilities. This facilitated the environmental knowledge and skills development to the pupils. However the interview and the observation made by the researcher revealed that very few teachers were willingly teaching EE through the use of ICT facilities.

Teachers on the other hand suggested that EE should be taught as early as possible in the primary school so that the foundation for an understanding of the importance of the environment can be established at an early age. This kind of thinking is expected in the Tanzanian context because from the time the children are very young they start to learn things around them and learn how to perform different tasks in their

surrounding environment. Talts and Vikat (2007) argue that early experiences in childhood have lasting effects on social development and behavioural competencies. After conducting this research the researcher also agreed with other researchers, that childhood experiences tend to have an effect in their surrounding communities particularly later in their lives.

However, it was encouraging to find that some teachers have employed their own ICT facilities to teach not to mention their own initiatives to attend the ICT training programmes in private institutions to enhance their ICT knowledge base. This can be seen as an indication that there are few innovative and motivated teachers who use their own efforts to update their knowledge, a spirit that needs to be developed.

5.6 Reflection on Methodology Used in the Study

The study focused on investigating the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in primary schools. The study employed the multiple case studies research design using the constructivist theory. Interviews, observations and questionnaires were used as major instruments of data collection from 09 selected primary schools in Musoma district. The sample of the respondents included 27 primary school teachers and 180 pupils from 09 sampled schools. The researcher was able to make lesson observations from all 09 sampled schools in order to investigate the effectiveness of the ICT training programmes in enhancing the integration of ICT facilities in teaching EE.

Alongside 09 lessons observed in each school, other school activities were also observed. The interviews were conducted in three phases (Figure 5.3 below). In

phase one, three teachers in each school were oriented to the meaning of ICT, available ICT facilities and ICT services that might be found at their schools, and the probable ICT training programmes that they might have undergone during their course of teaching. The exercise was conducted through participatory method where each teacher was allowed to provide his/her views with regard to the issues at hand.

The aim was to get an overview of the teachers' knowledge of ICT and EE as an integrated component in the primary school programmes. In phase two, three teachers in each school were interviewed in order to get in-depth information on what is known to them with regard to ICT by also referring to what was oriented to the teachers in phase one. In the third phase the researcher was able to meet the respondents whom she had missed the opportunity to meet in phase one and phase two. The process was successful after making appointment with the responsible teachers. This assisted the researcher to get all the teachers' respondents (100%) that she had planned to have in the study.

The lesson observations were done to gain insight on how the teachers employ the ICT knowledge, facilities and or services to teach EE in their lessons through different subjects that contain EE. The lesson observations were done to complement what the teachers said in the interview. Finally, the researcher through the assistance of other trained assistant researchers was able to conduct the questionnaires to both teachers and pupils' respondents.

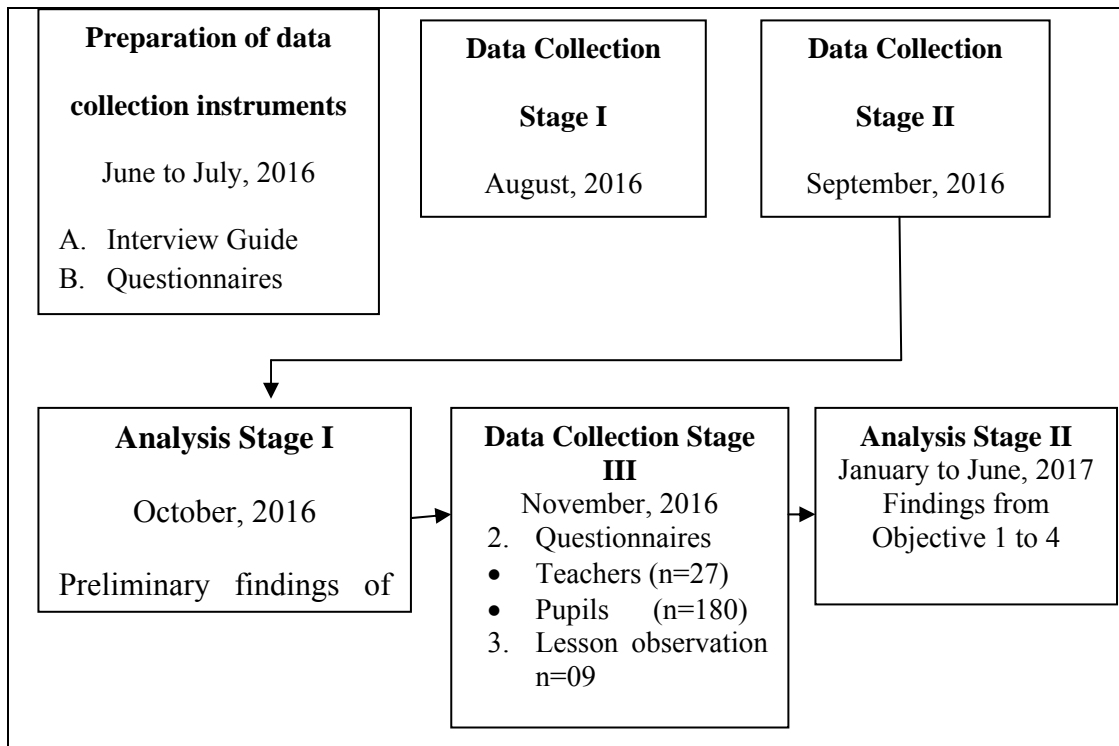


Figure 5.3: Data Collection and Analysis Process

In conducting interviews, there is a risk that the respondents may not tell the truth but respond to the interviewer what they think he/she expects to hear. To minimize this risk, the interviews started with an informal discussion concerning the interviewees' education and their work as primary school teachers. On the other hand, the researcher had to introduce herself and to explain to the respondents the purpose of research. The researcher assured the respondents that the collected data are purely for the purpose of academic career and not for administrative purpose. These made the respondents to feel free to express their feelings and experiences with regard to the EE teaching and learning process using the ICT facilities.

In addition, the respondents were assured on the issue of anonymity and that the data they were providing will be given the confidentiality it deserves. The assurance of confidentiality increased the freedom of expression to the respondents. The

researcher began with the introduction sessions and thereafter the interview moved on to the issue of how the ICT training programmes have provided to the teachers' skills and knowledge to assist them integrate ICT in the EE teaching and learning process. To ensure that the respondents were responding specifically to the research questions, the researcher was trying her level best to be consistent with the research questions in the interview guide and providing clarifications wherever necessary. Also the researcher requested for more clarifications and or examples from the respondents in the areas which were not clear to her.

The interviews were then complemented with the lesson observations and thereafter questionnaires in order to make sure that the results are enriched with different types of methodologies (triangulation). Therefore from the triangulation, the results revealed that after the training, teachers got the opportunity to use the knowledge in teaching EE although they commented that they did not get sufficient knowledge to enable them integrate the ICT facilities effectively. The interviews were transcribed and analyzed to get the results. In analyzing the interviews the researcher's task was to interpret and try to understand what the teachers said correctly.

One can question whether it can be ensured that the interpretation of the teachers' utterances was done correctly. First, being a teacher helped the researcher to understand what the teachers said during the interview. Secondly, during the interview, the probing questions were asked to get more clarification of the statements which were not understood. Thirdly, since the interviews were tape recorded to some of the respondents who willingly accepted to be recorded, if it was not clear what the teachers' respondent has said, the researcher simply replayed the

tape when transcribing the interviews.

Another method used for data collection was lesson observation. In all 09 sampled schools, different EE lessons were observed. The researcher sought the consent of the teachers to come into their classrooms and observe how they were teaching. The teachers were willing, so they taught as they normally did. One may wonder if the presence of the researcher in the classroom interfered with the normal teaching. In order to assure undisturbed learning environment to the pupils, the teacher who was teaching during the observation explained to the pupils about the research that was being carried which assisted the pupils to relax. Also teachers and pupils were used to inspectors and teaching practice supervisors who were going to the school to observe teaching in the classroom. After the lesson observation, the teachers, together with the researcher, reflected on the lessons that were observed. One can also ask why interviews, lesson observations and questionnaires were used.

The essence of using mixed tools of data collection was to listen to the respondents' views and to complement what were said in the interview. Through observation, the researcher was able to see how what was said in the interview is put into practice. Also observations were used to verify what was said because sometimes people do not practice what they say. The study further used the questionnaires to both the teachers and pupils in order to enrich the data and for the assurance of reliability. In addition, pupils were also included in the study in order to complement the data that were obtained from the teachers. Therefore, in order to understand a certain practice, the best way is to see or observe how it is done. Interpretation of the data was organized and presented in categories and aspects/sub-categories. The researcher

presented the description of the data using the categories and aspects which were generated from the data and supported them with extracts from the interviews to show the teachers utterances as they were expressed in the interviews.

Concerning the research methods used, one can ask if the use of constructivism paradigm was successful in yielding rich data for the study. Based on how the study was carried out and on the findings, the researcher believes that the data collected through interviews, observations and questionnaires are quite rich. To a large extent, it has exposed what teachers actually perceive and how they actually integrate ICT in teaching EE in primary schools after the ICT training programmes they have received. The researcher used qualitative data obtained through interview and observation and also quantitative data obtained through questionnaires. The intention was to get assurance of more reliable data through the use of triangulation of various methods of data collection by covering a wide range of teachers with different characteristics. Therefore, the researcher think that the findings of the study can be used to shed light on how effective was the ICT training programmes in enhancing the integration of ICT in teaching EE in primary schools in Tanzania using Musoma district as a representative sample.

5.7. Appraisal of the Model used in the Conceptual Framework

This study adopted and modified the Guskey's model and used it as a conceptual framework to investigate the effectiveness of ICT training programmes in enhancing the teaching and learning of EE in primary schools. The model was suitable for this study because the study investigated the effectiveness of the education programme whereas the model provides the basis for evaluation of any education programme.

The model indicates the relationship of various levels with regard to teachers' professional development and how an education programme (ICT training programme) has contributed towards the teachers' professional development. The levels of the model include teachers' reactions about the training that is if teachers were satisfied with the ICT training programmes, teachers acquiring of new intended knowledge that is whether teachers gained the acquired knowledge and skills from the experience they got from the ICT training, teachers' use of ICT knowledge in teaching and learning of EE, organization support to teachers after the ICT training and if the teachers got sufficient ICT resources after the training. In addition, the model has the part of pupils' reactions about the new ways of using ICT in learning EE.

With the guideline from the Guskey model teachers' in the study showed their reactions that they liked the ICT training programmes that are being conducted by the government in primary schools. Teachers commented that the ICT training programmes conducted at various levels are very useful towards enhancing teachers' use of ICT facilities in teaching and learning process. However teachers indicated that the training programmes were not effectively conducted in enhancing teachers' acquiring of new intended knowledge. As a result, even after the training, teachers were still facing a number of challenges in trying to integrate the ICT facilities in EE teaching and learning process.

In terms of new ICT knowledge and skills teachers complained that the training based more on theoretical rather than the practical part of the training in that case hampering their ways of presenting the lesson in the classroom. On the other hand

teachers lacked the support they expected from the school administration after the training, disabling teachers to use the ICT facilities in teaching and learning process.

However, although the model was useful in this study, on the other hand, the model seemed to be too general and applicable directly in some professional development as it based its evaluation in five critical levels of professional development. The model did not directly apply the pedagogical development of teachers as teachers can be distinguished from other professional development by acquiring the pedagogical skills and knowledge. The model, for example, has not taken into consideration pedagogical skills in relation to ICT training to teachers.

The findings of this study therefore, suggest a model which incorporates five aspects.

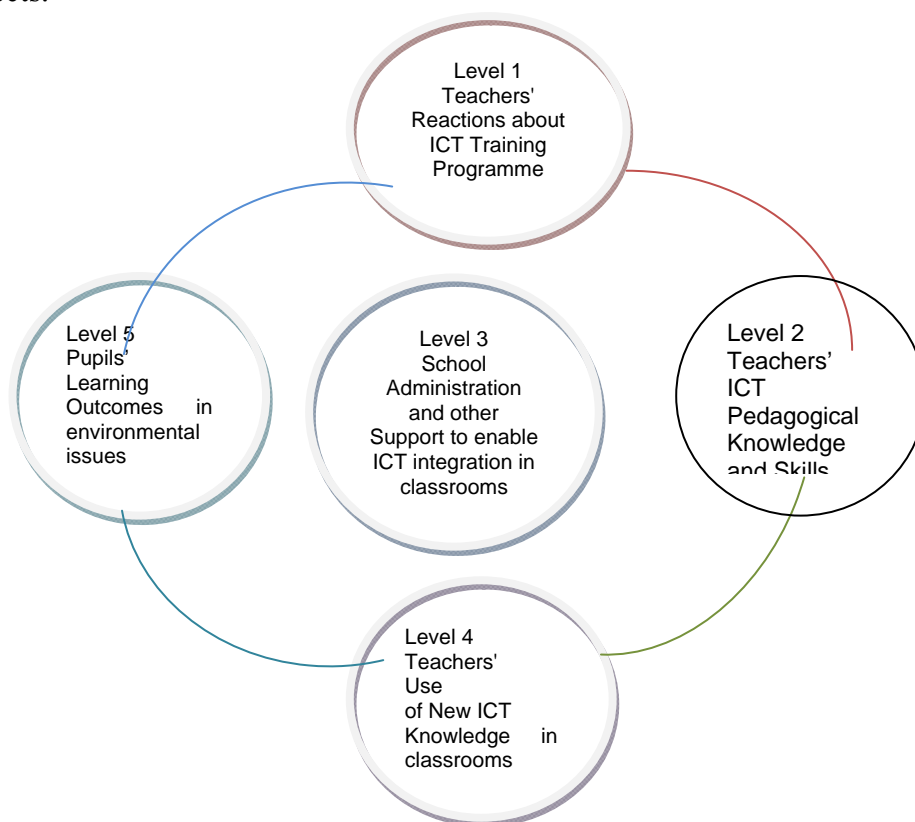


Figure 5.4: The Model for the Study

In addition, the model has not taken into consideration various aspects such as the characteristics of the training programmes where the methodologies and content of the ICT training could have been described to enable someone assess the characteristics of the training. Also the technical part of training of ICT to teachers has not been integrated in order to make sure that teachers are well equipped with technical knowledge to assist teachers when it comes to the operation and repair of ICT instruments.

The above model could be useful in describing the ICT training programmes to the teachers as far as educational professional development in ICT is concerned. Most of the educational programmes have not been yielding the positive results due to among other reasons lack of onsite and ongoing support from the educational administrators. Therefore the above model has considered the administration and other support to be at the centre to enable the sustainability of the ICT training programmes as the core of ICT professional development to teachers. The model suggests that teachers should be supported during the training and after the training. Thereafter teachers should be supported while they are integrating the acquired ICT knowledge and skills during the teaching and learning process.

The findings of this study revealed that sometimes things break at the educational institution level after the ICT training. Therefore education institutions should try as much as possible to support the teachers after any professional training. The support will encourage teachers to use the new technology as well as implement the new technology at the school level. The proper implementation of any new technology will enhance the effectiveness of teaching and learning which in turn will improve

the pupils' learning.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This study was conducted to investigate the effectiveness of ICT teachers' training programmes in enhancing the teaching and learning of EE in selected primary schools in Musoma district. The review of various literatures was carried out to find out the existing knowledge with regard to various theories and other empirical underpinnings related to this study. In addition the findings and discussions emanating from the effectiveness of ICT training programmes to enhance the teaching of EE while integrating ICT in selected schools of Musoma district have been presented. In this chapter, the main conclusion for the study, recommendations and suggestions for further research are presented.

6.2 Conclusion

Successful integration of ICT into EE teaching-learning process, it can be concluded that the ICT training programmes should be adequately prepared to cater for the ICT pedagogical knowledge and skills to enhance the teachers' professional competence. In addition the facilitation of ICT training programmes should cover both theoretical and practical parts of the training at least to enable teachers with ICT basic technical issues. Effective ICT training programmes will enhance the use of modern methodologies in EE teaching and learning hence enabling pupils with appropriate knowledge and skills of combating environmental issues in the digital world.

6.3 Recommendations

Given the available potential benefits of ICT training programmes in enhancing EE

teaching and learning in primary schools, the following recommendations are made for immediate action, for policy review and for further research.

6.3.1 Recommendations for Action / Practice

Effective ICT training to teachers should be enhanced to enable efficient use of ICT facilities in EE teaching and learning process. The use of ICT facilities will make the learning meaningful to the pupils as they go back to their societies after finishing their primary education. After completing their primary education, most of the pupils engage in various activities such as farming, mining, fishing, livestock keeping to mention a few which have the impact on the environment if not sustainably performed. Therefore, it is important to ensure that in the world that is developing so fast in terms of technology, pupils are effectively taught using ICT facilities to assist them so that they won't lag behind with the technology. If EE is efficiently taught in primary education, which is considered to be basic education to every citizen, majority of Tanzanians will be able to use the modern technologies in their daily lives and therefore reduce the impact of their day to day activities in the environment.

6.3.2 Recommendations for Policy Review

On the other hand this study revealed that teachers are facing various challenges in using ICT facilities to teach EE even after attending various ICT training programmes. Therefore, the training of teachers in the pedagogical issues should be increased if teachers are to be convinced of the value of using ICT in their teaching-learning process. Also continuous professional development in a workplace environment and as part of a culture of lifelong and peer learning, building up a clear

political will and other related factors will consolidate investment in ICT. In addition, more ICT resources should be provided to each primary school institutions to enable teachers get sufficient and reliable ICT facilities to enhance the teaching and learning of EE after the training. It is envisaged that proper and well implemented ICT policy for basic education, leadership and colleagues support, and other related factors will increase the probability of excellent integration of ICT in EE teaching-learning process.

Needless to mention, teachers are the foremost individuals to be trained and oriented on how to integrate ICT in their teaching processes enhanced with ICT. Moreover, teachers' education institutions must help teachers to understand how the new technologies can best be used in the context of the culture, needs, and economic conditions of their country. Hence, building the capacity of teachers in the EE teaching and learning process. Even after the training, teachers are required to get the support both from their colleagues and from the school administration specifically for the technical part of basic skills of operating the ICT facilities since the training might not cover the technical part. However, inadequate ICT facilities on the other hand were seen as a major challenge to the teachers even after receiving the ICT training. To overcome this challenge, apart from the ICT training programmes that are being conducted in schools for example the TEA programme in Musoma district, the government through MOEVT should as well distribute the ICT facilities in primary schools.

In addition the schools may organize through the parents' meeting on how to contribute funds for the purpose of purchasing ICT facilities. Alternatively, the

school administration may write the project to the donors to contribute funds to enhance the availability of ICT facilities in primary schools. Also teachers can be motivated with little honoraria to have ICT self-learning from private and other available ICT training colleges in order to get more advanced ICT training. Teachers can as well develop the culture of e-learning where they can enrich themselves with EE resources to assist them have the up to date knowledge to teach pupils.

Finally, in order to make sure that EE in primary schools is efficiently taught using ICT facilities, proper guidelines should be prepared by MOEVT and delivered to teachers. The guidelines should state clearly how to teach with ICT facilities, what, where and when to teach. Since teachers are the main implementers of EE expecting to deliver the knowledge to the pupils, they need to receive adequate pre-service and in-service ICT training programmes so that they are equipped with new ICT knowledge every now and then to assist them with the changing technology. The study generally shows that ineffective ICT training programmes incapacitate the professional competence for technology use to the primary school teachers. This has been revealed to be a serious challenge in enabling teachers to fully integrate technology in teaching and learning process.

The ICT training programmes have to be thoroughly included in the teacher education curriculum as well as the in-service ICT training programmes to be introduced to all teachers in all the primary schools instead of only few primary schools. The programmes should also be well implemented and well monitored. The training programmes that are well planned, well implemented with ongoing support, designed with built-in evaluation and sustained by adequate financial support will

assist teachers to comfortably integrate ICT facilities in EE teaching and learning process.

6.3.3 Recommendations for Further Research

The integration of ICT in teaching EE is expected to facilitate effective teaching of EE in primary schools. The use of modern methodologies of teaching will enhance meaningful learning to the pupils who if well prepared are expected to bring the immediate effect when they go back to their society. Pupils are expected to bring immediate impact to their societies because their livelihoods and that of their societies depend on the environment and therefore the knowledge which they get will be deployed to the society to help the society in combating the environmental issues in their day to day life situations.

This study focused on two major areas which are ICT training programmes and their effectiveness in enhancing the integration of modern ICT facilities in teaching and learning of EE. All the above mentioned areas still have potential interesting research topics. Various issues such as specific ICT training programmes to the primary school pupils and the use of available ICT facilities have been briefly covered in this thesis and therefore can be explored further. This study focused on primary school education but another study can be conducted in secondary education and other education sub-sectors. This would reveal various practices that may enhance changes in teaching using ICT especially in primary schools. In addition, this study was conducted in urban area but another study can be conducted in rural areas. More important another study can be conducted in teachers' colleges to

explore the teaching of ICT to the prepared primary school teachers. This is because teachers are expected to have the multiplier effect in disseminating knowledge to the pupils particularly the EE knowledge.

Therefore when the foundation is well built through the ICT pre-service training programmes there is a higher expectation that teachers will deliver well when it comes to teaching and learning of EE. The study in teachers' colleges will shed light on how the teachers are trained and prepared to teach in the digital world. For example, one can conduct the study on how the training of teachers can contribute to the effective integration of ICT in teaching EE. The findings of this study revealed that majority of the teachers are not competent in integrating ICT in teaching EE because they lack the ICT knowledge base from either the pre-service ICT training programmes or in-service ICT training programmes. The knowledge base is very important to the teachers to enable them teach effectively. Therefore research on teachers' colleges can assist to find out if they get effective training to enhance them with the knowledge and skills of integrating ICT in teaching EE. The results of such a study can be a good basis for planning both ICT pre-service and in-service training programmes to teachers.

6.4 Contribution of the Study in the Body of Knowledge

The findings of the study revealed that the ICT training programmes, as they have been conducted among the primary school teachers, are not effective in enhancing the teaching of EE using ICT facilities. It was expected that during this era of advancement in science and technology, teachers would be capable of using modern

tools in teaching and learning particularly after ICT training. The modern ICT facilities were expected to improve the teaching of EE for the betterment of the national since there is still a struggle towards environmental conservation. Modern teaching of EE using ICT facilities were expected to lessen the environmental problems.

However, the results confirm that there are number of challenges that hamper the teaching of EE while integrating ICT facilities one of them being ineffective ICT training from both pre-service and in-service training programmes. Even the training that were conducted were revealed to be ineffective in enhancing the use of ICT in teaching and learning of EE as they did not have definite content whereas the methodology used were more theoretical rather than practical. However, the teachers' practices in integrating ICT in teaching EE were different from one teacher to another.

The findings confirm that the challenges that hampered the use of ICT facilities in teaching EE included teacher related challenges, curriculum related challenges, teaching and learning related challenges. The findings of this study shed light on how the ICT policy for basic education (MOEVT, 2007) is being implemented in primary schools in order to suggest for the improvement of the identified challenges. The findings can also be useful to various key policy makers in education in the implementation of EE through the use of modern ICT facilities in primary schools in order to contribute to the struggle against environmental degradation. Effective ICT training programmes to teachers are expected to assist the teachers to improve their ways of teaching through the modern teaching technologies. The modern

technologies assist teachers to integrate the ICT facilities which contribute to the improvement of EE teaching and learning process.

Primary school teachers in Tanzania are not well equipped with the ICT knowledge and skills since its establishment in 2007 as stipulated by the MOEVT policy (ibid). However, the trainings, particularly the in-service ICT training programmes, were reported to be inadequate in terms of content to the extent that even for the conducted training, teachers stated that what they expected from the training was not clearly stated. The content of the ICT training was revealed to be less detailed to the extent of hampering effective teaching and learning of EE. Therefore this research is a cornerstone of how best MOEVT should rethink to make ICT training programmes more effective among the primary school teachers in the quest for the improvement of EE teaching through the modern technologies.

The study identified that majority of teachers are not competent in integrating ICT in the teaching of EE. This indicates that the extent to which the issues of ICT training programmes are addressed in enabling teachers to teach EE is still very low. As a result the study revealed that teachers are experiencing challenges in integrating ICT to teach EE due to lack of ICT pedagogical content knowledge which assist to improve the teaching methods. Majority of the teachers' respondents revealed that they have received the ICT training but the content was not well covered and the training did not cover well the practical part. To worsen the challenge, the in-service ICT training programme that was conducted through TEA involved very few teachers and in few selected schools. The researcher conducted the study to the educational institutions in this case primary schools because it was envisaged that

education is a strong weapon in the war against environmental degradation. Primary education is considered to be the basic and free education to the Tanzanian citizen hence EE is considered to reach as many Tanzanians as possible through primary schools. When EE is not well implemented at this basic level then this is considered as a setback to the Tanzanian education system.

Teachers are considered to be important in disseminating knowledge in this case the knowledge of EE. Teachers have potential multiplier effect which is important in assisting the use of ICT facilities to disseminate EE. However, teachers need the well prepared pre-service ICT training programmes in order to equip them with the up to date knowledge to assist them deliver well. Emphasizing the need for in-service training, Sanera (1998) suggests that teachers need to be helped to keep in pace with the constantly changing science and technology which involves environmental issues.

According to UNESCO, environmental education and education for sustainable development should be incorporated into ordinary educational activities and curricula have to be reoriented for all educational levels from pre-school to university level (UNESCO, 2005). Teachers have a big multiplier effect because each teacher is capable to educate a large number of pupils who will then share the knowledge with others at home and in the community (Lindermann-Matthies, 2009). For effective implementation of ICT in teachers' colleges, responsible organs should make sure that ICT as a subject is effectively covered in teachers' colleges. This in turn will enhance the availability of well trained teachers in primary schools who in turn will effectively teach EE to the pupils using the modern ICT teaching facilities.

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APPENDICES

Appendix 1: Interview Guide to Teachers

1. What is EE? How is EE curriculum currently implemented in primary schools?
2. What kinds of ICT are available and can be accessed by EE teachers in the schools?
3. What are the teachers' perceptions and knowledge about ICT integration in education?
4. To what extent are teachers' willing to integrate ICT in the teaching and learning of EE lessons?
5. What are the teachers' training needs for effective integration of ICT in teaching of EE?
6. Did you have any training with regard to the use of ICT facilities in teaching and learning process?
7. What ICT opportunities are found at your schools that enhance the teaching and learning of EE?
8. What are the challenges that you are facing in using the ICT facilities in teaching and learning of EE? How do you face those challenges?
9. What characteristics of ICT teachers' training programme you think are effective in making ICT enhance teaching of EE?
10. To what extent do you think ICT teachers' training programmes are effective in enhancing teachers' professional competence in teaching EE?
11. What do you think are the strategies to be introduced in order to mainstream ICT to enhance the teaching of EE in schools
12. How do you effectively employ the available ICT resources at your school to teach your students the topics of EE?

Appendix 2: Questionnaire for Teachers

1. INTRODUCTION

This questionnaire is intended to collect information related to the Effectiveness of ICT Teachers' Training Programmes in Enhancing the Teaching and Learning of Environmental Education (EE) from teachers' perspective. Please answer all questions by putting a tick (v) against the statement for the response you find appropriate. You are also free to fill in the brackets if you have any addition. The information that you provide in this questionnaire will remain confidential and will be used for the purpose of this study only.

2. BACKGROUND INFORMATION

(i) Name (optional).....

(ii) Gender (please tick where appropriate)

Male (☐)

Female (☐)

(iii) Age

25 – 35 (☐)

36 – 46 (☐)

47 – 57 (☐)

48 – 68 (☐)

(iv) Computer literacy level

Advanced (☐)

Average ()

Low ()

(v) Teaching experience

00 – 10 ()

11 – 20 ()

21 - 30 ()

31 – 40 ()

(vi) Name _____ of _____

School.....

2. QUESTIONS

RQ.1. How is EE curriculum currently implemented in primary schools?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
EE is well implemented in primary schools				
EE lessons are taught using ICT facilities				
EE is found in most of the subjects in primary school curriculum				
I teach EE more comfortably when using ICT facilities				
Teachers are willing to integrate ICT in the teaching and learning of EE				
The school administration supports the use of ICT in the teaching of EE				

If you have additional notes/comments or advice write in this space.....

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RQ.2 What kinds of ICT are available and can be accessed by EE teachers in the schools?

Statements	Responses			
	To great extent	To some extent	To less extent	Not at all
Radio programmes are used by teachers to teach EE in primary schools				
TV programmes are available at primary schools to facilitate the teaching of EE				
Computer programmes are enhanced to primary school teachers to enable them acquire ICT knowledge				
The school has the ICT helpdesk (adviser and specialist) and or ICT resource centre to assist teachers in their teaching process				
Mobile and telephone assist teachers to get materials for teaching EE to their students				
Other services please specify in this				

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RQ.3 What are the teachers perceptions and knowledge about ICT integration in education?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
I would like to use ICT materials but I don't have skills on computer applications				
I like using ICT materials because it is very interesting which leads me to read much				
Unreliable electricity makes the use of ICT materials unrealistic at times				
Technology infrastructures for ICT materials are expensive				
I don't use ICT materials to teach students because I don't have a computer to access the teaching materials				
I find using ICT materials increases learning flexibility by increasing options of learning resources				
I can easily share ICT study materials with my students as it is less expensive to use them				

RQ.4 To what extent are teachers willing to integrate ICT in the teaching and learning of EE lessons?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
Some of the primary school teachers still have traditional culture of teaching and learning styles				
Teachers with appropriate skills of technology use are insufficient at primary schools				
Most primary school teachers lack technological competence to put ICT materials into use				
I have limited knowledge to use ICT facilities in my teaching				
Primary schools lack appropriate software to prepare attractive ICT materials				

RQ.5. Were the characteristics of ICT teachers' training programmes such as content and methodology effective in enabling teachers' professional competence of using ICT in teaching EE.

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
The training of ICT covered well the content it was supposed to cover				
The methodology used to facilitate the ICT programmes were supporting the coverage of the content that was supposed to be covered				
After the training teachers can willingly integrate ICT in the teaching and learning of EE				
After the training teachers can teach EE more comfortably using ICT facilities				
After the training, the school administration supports the use of ICT in the teaching of EE				

If you have additional notes/comments or advice write in this space.....

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RQ.6 Were the ICT teachers' training programmes effective in enhancing teachers' professional competence in teaching and students' learning of EE.

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
After the ICT training, teachers with appropriate skills of technology use are sufficient (enough) at primary schools				
After the training, some of the primary school teachers still have traditional culture (are not using ICT facilities) in teaching and learning styles				
Most primary school teachers lack technological competence to put ICT materials into use				
The training was able to cater for teachers' limited knowledge of using ICT facilities in their teaching				
After the training, teachers have the knowledge to prepare attractive ICT materials using the appropriate software				
The use of ICT materials increases learning flexibility by increasing options of learning resources				
I can easily share ICT study materials with my students as it is less expensive to use them				

RQ.7 What strategies should be introduced for mainstreaming of ICT to enhance EE teaching in schools?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
I need more specific training on ICT materials' design and development				
I need pedagogical support during preparing ICT study materials				
I need more facilitation of knowledge in using ICT study materials for teaching and learning process				
I don't have technical knowledge to repair the computer when it is damaged				
Sometimes computer may undergo faulty so there will be no access to the teaching materials				
I find using ICT materials time consuming in teaching and learning process				

THANK YOU FOR YOUR COOPERATION

Appendix 3: Questionnaire for Pupils

1. BACKGROUND INFORMATION

- A. Name (Optional) D. Name of
School.....
- B. Age..... E.
Class.....
- C. Gender: A. Male B. Female (Tick one) F. Email address (optional).....

2. QUESTIONS

RQ.1. How is EE curriculum currently implemented in primary schools?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
EE is well taught in primary schools				
We learn EE lessons using ICT facilities				
EE is found in most of the subjects that we learn in primary school				
I learn EE more comfortably when taught using ICT facilities				
Students are willing to integrate ICT in their EE learning process				
The school administration supports teachers to use ICT in the teaching of EE				

If you have additional notes/comments or advice write in this space.....

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RQ.2 What kinds of ICT facilities are available and can be accessed by EE learners in the schools?

Statements	Responses			
	To great extent	To some extent	To less extent	Not at all
Radio programmes are used by learners to learn EE in primary schools				
TV programmes are available at primary schools to facilitate the learning of EE				
Computer programmes are available at primary schools to assist learners to acquire EE materials				
The school has the ICT helpdesk (adviser and specialist) and or ICT resource centre to assist learners in their learning process				
The available ICT facilities are well employed in facilitating the learning of EE				

Other services please specify in this space

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RQ.3 What are the learners perceptions and knowledge about ICT integration in education?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
I would like to use ICT materials but I don't have skills on computer applications				
I like using ICT materials because it is very interesting which leads me to read much				
Unreliable electricity makes the use of ICT materials unrealistic at times				
I don't use ICT materials because I don't have a computer				
I find using ICT materials increases learning flexibility by increasing options of learning resources				
I can easily share ICT study materials with my fellow students as it is less expensive to use them				

If you have additional notes/comments or advice write in this space.....

.....

RQ.4 To what extent are learners willing to integrate ICT in the learning process of EE lessons?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
I have limited knowledge to use ICT in my learning process				
Teachers with appropriate skills of technology use are insufficient at primary schools therefore difficult to facilitate ICT in the learning process				
Most primary school teachers lack technological competence to put ICT materials in facilitating the EE learning process				
Some of the primary school teachers still have traditional ways of teaching and learning styles				
Primary schools lack appropriate software to prepare attractive ICT materials to be used in the learning process				

If you have additional notes/comments or advice write in this space.....

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RQ.5 What are the learners' training needs for effective integration of ICT in the learning process of EE?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
I didn't undertake any training on ICT materials design and development				
I don't have knowledge in using ICT study materials				
I find using ICT materials time consuming				
Sometimes computer may undergo faulty so there will be no access to the materials				
I don't have technical knowledge to repair the computer when it is damaged				

RQ.6. Were the characteristics of ICT teachers' training programmes effective in enabling students using ICT in learning EE.

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
The training of ICT covered well the content it was supposed to cover to enhance the effective learning of EE				
After the training teachers can willingly integrate ICT in the teaching and learning of EE				
After the training teachers can teach EE more comfortably using ICT facilities				
After the training, the school administration supports the use of ICT in the teaching of EE				

If you have additional notes/comments or advice write in this space.....

.....

RQ.7 Were the ICT teachers' training programmes effective in enhancing the learning of EE?

Statements	Responses			
	To a great extent	To some extent	To less extent	Not at all
After the training, some of the primary school teachers still have traditional culture of teaching EE to students				

After the ICT training, teachers with appropriate skills of technology use are sufficient (enough) at primary schools to enhance the learning of EE				
Most primary school teachers lack technological competence to put ICT materials in facilitating EE learning				
The ICT training was able to cater for the teachers' limited knowledge of using ICT facilities in facilitating students' learning of EE				
After the training teachers have the knowledge to prepare attractive ICT materials using the appropriate software				
Using ICT materials increases learning flexibility by increasing options of learning resources				
I can easily share ICT study materials with my students as it is less expensive to use them				

RQ.8 What strategies should be introduced for mainstreaming of ICT to enhance EE teaching in schools?

Statements	Responses			
	To great extent	To some extent	To less extent	Not at all
Teachers need more training on ICT materials' design and development				
Teachers need pedagogical support during preparing ICT study materials				
Teachers need more facilitation of knowledge in using ICT study materials to teach students				
Teachers don't have technical knowledge to repair the computer when it is damaged				
Sometimes computer may undergo faulty so there will be no access to the materials for learning				
I find using ICT materials time consuming in learning				

THANK YOU FOR YOUR COOPERATION

Appendix 4: Observation Guide

The researcher will observe the following

1. Do the sampled schools have the ICT devices to facilitate EE teaching and learning process
2. Are the capacity of ICT facilities sufficiently equipped to cater for the teaching and learning needs of the school
3. Are the primary school teachers enhanced to use ICT devices in teaching EE in the classroom
4. Are there any extra curriculum activities outside the classroom to translate EE knowledge into practice

Appendix 5: Permission Letter for Data Collection

**THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION & LOCAL GOVERNMENT**

MARA REGION
Tel. No. 028-2622005, 2622004,
2622305

Fax No. 028-2622324/2622764
E-mail: rasmara@pmoralg.go.tz



**REGIONAL COMMISSIONER'S OFFICE,
MARA REGION,
P.O. BOX 209,
MUSOMA.**

Ref. No. FA 190/270/01/452 28 September, 2015.

District Administrative Secretary,
P.O. Box 20,
Musoma.

RE: RESEARCH PERMISSION FOR Ms. FLORA KIWONDE

Reference is made to the above mentioned subject.

The above name is a student of **Open University of Tanzania** pursuing Doctor of Philosophy (PhD), who is at the moment conducting her research.

The purpose of this letter is to inform you that permission has been granted to her to conduct her research in Musoma District for a period of one month.

The title of the Research is **"THE EFFECTIVENESS OF ICT TEACHERS TRAINING IN ENHANCING THE TEACHING AND LEARNING OF ENVIRONMENTAL EDUCATION IN SELECTED PRIMARY SCHOOLS : A Case of Musoma District"**.

Please give any help that may facilitate her to achieve her research objective.


 Innocent G. Mariwa
**For: REGIONAL ADMINISTRATIVE SECRETARY
M A R A**

Copy to: Mr. FLORA KIWONDE